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Vol. 46 FEBRUARY–MAY, 1959 No. 1–2

A NEW SPHENOPHYLLALEAN SHOOT SYSTEM FROM THE PENNSYLVANIAN

TOM L. PHILLIPS*

Introduction

Investigations of American coal balls from the Pennsylvanian by Andrews and Mamay (1951), Baxter (1950), Hoskins and Cross (1943), and Mamay (1954; 1959) have greatly enlarged the anatomical knowledge of Sphenophyllalean fructifications; however, new petrified vegetative remains have not been described.

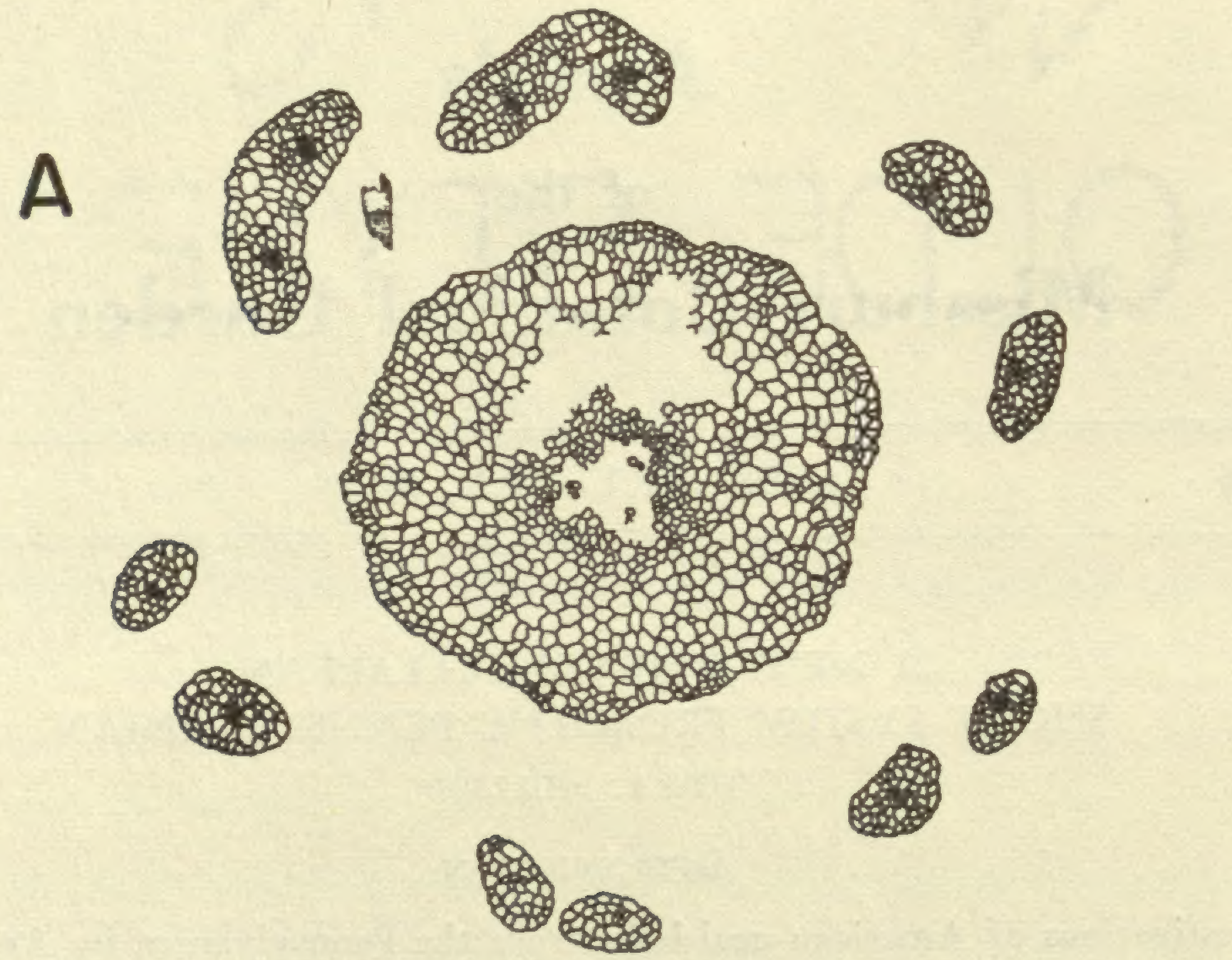
Sphenophylla referrable to European species were reported from North America in Ohio by Newberry (1853) while Lesquereux (1858; 1860) among others, described numerous new compression species from Missouri to Pennsylvania. In a specimen of *S. emarginatum* from New Brunswick, Canada, Dawson (1865) found the xylem consisted of a single group of reticulate or scalariform vessels.

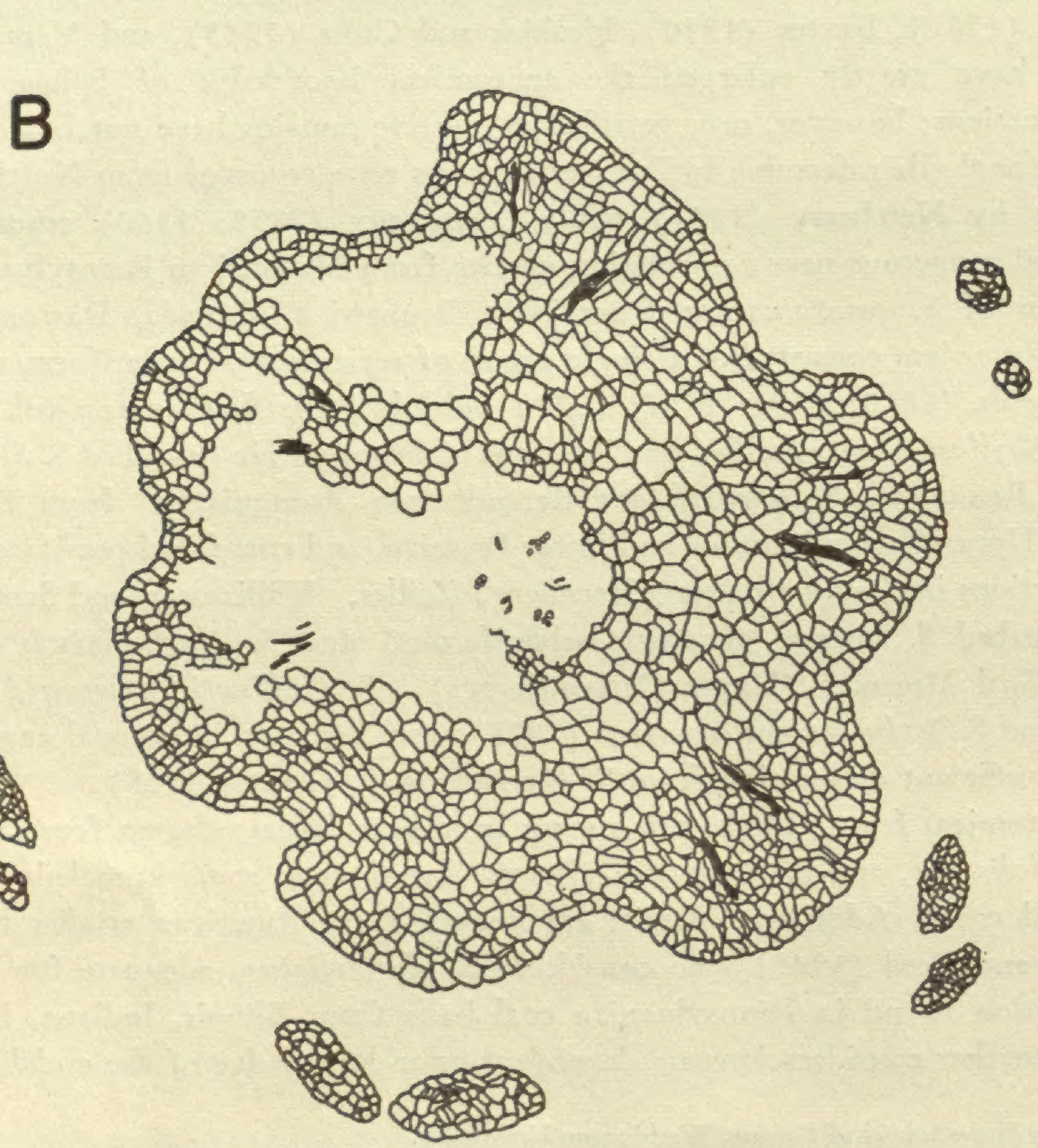
Renault (1870; 1873; 1876; 1878) published the first anatomical details of *Sphenophyllum* from silicified petrifactions of France. He described *S. Stephanense* and *S. Renaultii* (*S. quadrifidum* Renault non Brongniart)[1] from Stephanian (upper-Upper Carboniferous) and lower Permian, and correlated petrifactions with compressions in *S. cuneifolium* (Sternberg) Zeiller. Williamson and Scott (1894-5) described *S. insigne* (Lower Carboniferous) and *S. plurifoliatum* from the Lower Coal Measures (Upper Carboniferous). *S. Gilkineti* Leclercq (1925), *S. minus* and *S. perforatum* Koopmans (1928) were based on internodal anatomy and show insufficient distinction from *S. plurifoliatum*, (Baxter 1948).

Anatomical features thus far known have been largely drawn from *S. insigne*, *S. plurifoliatum*, and *S. Renaultii*; all were based upon some knowledge of node, leaf, and root. Additional details are known from American studies by Baxter (1948) and Reed (1949) who considered *S. plurifoliatum* adequate for the range of variation found in Pennsylvanian coal balls from Illinois, Indiana, Iowa, and Texas; further considerations are dependent upon knowledge of the nodal anatomy.

* Henry Shaw School of Botany, Washington University.

[1] See Appendix.





Text Figure 1. *Sphenophyllum constrictum*, transverse sections. A, Internode above (Slide 2743); B, Node (Slide 2739). ×20.

Materials

The following description was based upon nine plant fragments or groups of fragments.[2] Serial peels from such remains, with numerous other sections, were taken from three middle Pennsylvanian coal balls, two from Kansas and one from Indiana.

One was collected by Dr. Henry N. Andrews at a pit mine (Wasson Coal Mining Company) ten miles north of Booneville, Warrick County, Indiana. The coal is Petersburg or Alum Cave (Indiana No. 5 Coal) and correlative with Harrisburg (Illinois No. 5 Coal) of the Carbondale group, upper-middle Pennsylvanian. Two additional specimens were found by Dr. Sergius H. Mamay at a strip mine (Pittsburgh and Midway Coal Company) between West Mineral and Hallowell, Cherokee County, Kansas. The Fleming coal occurs in the upper part of the Cherokee shale, Des Moines series, middle-middle Pennsylvanian.

Sphenophyllum **constrictum** sp. nov.—General Description

Despite the generally parenchymatous nature of the plant, preservation is remarkably good. Various stages of development were preserved, which are referred to as young, mature, and old, although certainly they could represent portions of the same plant. The term young refers to portions displaying the primary body, often incomplete; mature, to secondary development without decortication; and old, to decorticated sections essentially of secondary tissue.

A comparative study of the plants from Kansas and Indiana was first initiated to determine their degree of similarity. Kansan material consisted of young and mature axes, and that of Indiana, mature to old. Mature stems in both provided bases for anatomical comparison. Figures 1 (Kansas) and 2 (Indiana) show the tissue relationships; anatomically, the two are not separable.

Nodal diameters of S. *constrictum* in mature stems are 4.5–5.0 mm. or about twice the internode of 2.5 mm.; the distance between nodes is 2.0 mm., resulting in a pronounced constricted appearance (fig. 4, 26). The shoot consists of a triarch exarch protostele with an adjoining parenchymatous cortex so characteristic as to easily separate S. *constrictum* from all other reported Sphenophylla. Dichotomizing leaf traces supply six bifid sessile leaves which are verticillate and superposed.

Text figure 1B shows the radially symmetrical nodal cross-section with six ridges intervened by grooves (one ridge is shown in fig. 14). The ridges are the six verticillate leaf bases which are distinct only as an equal number of leaves arise. The four pairs of leaf tips shown peripherally are from the node below; in young stems with slight internodal elongation, leaves exceed the height of the node next above. Diverging lines in leaf bases indicate passage of the dichotomized veins.

Text figure 1A shows the more rounded and reduced outline of the internode and the six whorled leaves which arose from the node of 1B, 0.45 mm. below.

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[2] Roman numerals after each figure explanation indicate from which of the nine specimens the picture was taken.

The bifid nature of each leaf becomes apparent beyond one-half to two-thirds of the distinct leaf distance from the fluted node. The two distal portions are uninerved and tapered, with papillate to apiculate tips. The leaves usually curve slightly upward, markedly so in young stems, or may project straight out from the foliar disc (text fig. 2A).

Stem—Primary Tissue

The vascular zone of a young stem may lack central cells, depending on metaxylem maturation, but there are several tracheids (15–20 μ) preserved at deltoid vertices (compare text fig. 1B with fig. 14).[3] In mature primary wood, merging of metaxylem cells (20–55 μ) with the three protoxylem groups is imperceptible except by the striking diminution of tracheid size toward each protoxylem vertex and the annular and spiral thickenings of the latter.

Metaxylem tracheids are best described as scalariform-reticulate. Although the thickenings are predominantly reticulate, there is transverse elongation toward the protoxylem (fig. 5). Elliptical to circular perforations of the radial and tangential walls appear to be simple pits, but previous reports (Renault 1878; Baxter 1948) indicate this is common due to border degradation. If the pits were bordered, the borders were quite fragile. Disintegration of protoxylary tissue resulting in lacunae occasionally occurred, but was local and discontinuous.

The area around the protostele is usually empty, and phloem is lacking. However, intervening tissue was preserved in the apical portion (fig. 22). Metaxylem is absent, and in the center are pyrite grains, not to be confused with the three equally black, in reality brown, groups of cells, CE, which alternate with the protoxylem; one group is preserved, PX. The three clusters of dark cells, CE, filled with resinous material, consists of 5–7 cells each, which are polygonal (40 $\times$ 90 μ) in transverse section and serially appear to be connected in a linear manner. What such tissue represents is questionable, because no evidence was found that it contributes to the V-trace from the stele. Remnants of such cells are referrable to the alternating vestiges of text figure 1B (CE, fig. 13–14).

Remains more comparable to nutrient conducting tissue, 2–3 cells thick, are radial to the protoxylem and peripherally delimited by a one cell layer (fig. 22). Such cells (20–30 μ), when separated by a V-trace, apparently join adjacent traces. Longitudinally, as in figure 10, cells with abutting transverse walls, PH, may represent phloem elements (130–150 μ long).

The primary cortex which directly adjoins the stele without a distinct endodermis or pericycle, is highly characteristic and separates S. *constrictum* from all previously reported Sphenophylla. The entire cortex is parenchymatous with isodiametric polygonal cells up to 150 μ; other species have thicker walled cortical tissue and occasionally remnants of an inner thin-walled cortex. The cortex accounts for four-fifths of the cauline diameter, and nodally there is no distinction

[3] The term tracheid is used in all cases referring to xylary elements, but this in no way obviates the controversy of tracheid versus vessel (tracheae) in *Sphenophyllum*.

between this tissue and the leaf base. The cortical dimensions are extremely flexible due to secondary growth which resulted in internal compression and eventual decortication.

Parenchymatous tissue of the cortex and leaf is bounded by a layer of rectangular epidermal cells (40 × 80 μ transversely), which often lack uniformity in shape and size. Epidermal cells are usually filled with brown to black residual matter, also seen in underlying cortical cells. In young plants, as in figures 26–30, cellular contents form a scattered pattern in the cortex, diminishing centripetally. In mature stems, most cortical cells are characterized by such residue, as in figures 1, 2, 9, and 10. In figure 7, a comparison in residual contents and relative development is shown between a main axis, A, and its branch.

Stem—Secondary Tissue

Decorticated stems with abundant secondary wood present a problem of identification, but in several cases the distinct primary cortex was not completely obliterated (C, fig. 6).

Tracheids increase in size centrifugally in concentric and vertical rows, and those opposite primary xylary vertices often show little distinction from others. The number of concentric rows opposite sides of the triquetrous primary wood, however, need not be equal (fig. 12); this is common in S. *plurifoliatum*. Reticulate bordered pitting is more abundant on radial walls, and pits without borders resemble perforations of the metaxylem. Truncate tracheidal angles indicate unpreserved vertical parenchyma cells (PC, fig. 6).

Secondary phloem was absent, and there was always a gap between the wood and periderm. Periderm cells are 75–100 μ long and often contain carbonaceous residue. The compact periderm gives way to a black amorphous tissue which clearly delimits the cortex.

Leaves

Thin walled epidermis is covered by a scant cuticle, lacking in most cases; in direct contrast, S. *plurifoliatum* and S. *Renaultii* have a thickened epidermis. Stomata seems to be very scarce, but an opening suggestive of such, ST, from a transverse section of lower epidermis, is shown in figure 23. Cutinized structures on either side may represent guard cells, and behind is perhaps the slightly recurved margin of a guard cell. Other possible stomata have been reported by Renault (1876) in S. *Renaultii* and by Reed (1949) in S. *plurifoliatum*; openings were embraced by guard cells flush with the lower epidermis.

At nodes where branches were not observed, the pattern of leaf traces in the cortex is similar to other species, differing in relative position and number of ultimate veins. One V-trace originates from each protoxylem group. Six leaf traces horizontally tranverse the cortex to an equal number of fluted leaf bases. Actual connection of traces to the stele is not seen in mature plants with tissue lacking between wood and periderm, but distortions of the intervening tissues indicate the vascular passage (fig. 9). In stems with abundant secondary tissue, all

such evidence is lost. In the apical region, the V-trace was seen in connection with the protoxylem, which is clearly singular despite the twin trace emanation.

At the leaf base, the course of the trace descends slightly, gradually turns upward (LT, fig. 26) and then dichotomizes (B, fig. 10), supplying each leaf with a pair of veins. Text figure 1B (compare with fig. 14) shows a transverse section of leaf bases passing through the two veins indicated by heavy black lines; tips of four leaves from the node below are radial to the leaf bases. Figure 13, slightly oblique, shows partial separation of a leaf from the foliar disc and subsequent median constriction. Figure 15, from the apex, shows two superposed leaves almost divided. The ultimate tips of a leaf are seen in figure 8. The resulting verticillate phyllotaxy with leaves divided is shown in text figure 1A. The leaves appear elliptical to circular in cross-section and lack the more angular margins of other species.

Figure 11 (leaf enlargement from fig. 26, upper left) shows the undifferentiated mesophyll merging into the cortex without distinction. Epidermal and peripheral cortical cells characteristically have black-brown contents.

Vascular elements of the leaf consist of a concentric bundle of five to seven elements (V, fig. 8); tracheids are known from ringed and helical remnants. In a well preserved leaf section (LT, fig. 11) elongated thin walled elements with cross-walls are seen. Encircling the leaf supply is a one cell layer with brownish content (LT, figs. 28–29). The conducting system terminates near each bifid tip without further ramification.

Branching

Branches were preserved in several developmental stages: primordial leaves (figs. 28–30), an elongated internode (fig. 31), and mature shoots (figs. 7, 32–33). They arise laterally in a variable association with leaves and are solitary at the nodes, but two are not uncommon. The branch trace originates at a vertex of the protostele, consequently, each branch is associated with one of three possible sets of leaves which derive their V-trace from the same vertex. When a branch arose, the V-trace of two associated leaves appeared to emanate with the branch trace, adjoining it below or laterally for a short distance.

Oblique cauline sections longitudinally through a nascent branch, as in figure 24 (enlargement of B, fig. 28), indicated the branch arose directly above a leaf by its relationship to the leaf trace, LT. Transverse serial sections of the young stem shown in text figure 1 presented two different branch-leaf relationships. In one case, a young branch apparently occupied the spatial position of the sixth leaf (text fig. 2A); the leaves extend straight out in the lower portion of this stem. Several peels later, the sixth and subtending leaf was seen in a mechanically displaced position similar to that in figure 29. Such growth between crowded superposed leaf whorls not only tends to push down the subtending leaf, but to displace the axis slightly. With subsequent growth, the branch slips toward one side of the leaf above. In a second case, two nodes lower, the branch arose almost exactly above and between two leaves. Such patterns were compared with other cases of branching; where the relationship of branch and leaf was ascertainable, branching

was as variable as the two extremes cited. Young branches as in figures 24, 28–31, and the above cases had no adventitious roots.

Basal Stem

The unique axis of figure 19 was found adjacent to the stem of figures 26–27. The section was serially peeled on four faces, and with 1.9 mm. of matrix removed from each, the axis abruptly came to an end with the emanation of several roots. Organic connection of either end with other fragments was not established, but anatomical comparison and association leave little doubt of unity with *S. constrictum*. From the larger diameter and emanating roots, it is considered the lower portion of a shoot.

A perpendicular bisect of the triquetrous stele is about 0.9 mm.; cells range from 20–75 μ. The entire structure is 5.9 mm. in its largest dimension. The three cortical flares represent modifications of the foliar disc, below which a reduced rounded internode was seen.

Lacunose structures of the three cortical flares are characteristic of the entire stem portion, although some have been altered by degradation. Consequently, some peripheral lacunae of the cortex open to the exterior; others do not. The lack of foreign material in such cavities indicates they were originally closed and perhaps aerenchymatous in nature, though some may have possessed openings permitting the entrance of one to three spinose spherical bodies, 50 μ in diameter, which occurred in several chambers, but were not identified.

Stem Apices

The apex is shown longitudinally in figures 24 and 31, and obliquely transverse in figures 20 and 25. The cortical area of cell elongation is discernible (C, fig. 31), but vascular tissue is indistinct and completely obscure near the tip. In fig. 20, concentrically arranged cells indicate the proximity of the meristematic region, MR; fig. 25 is 0.7 mm. higher. Preservation above the stelar area was lacking, and the actual nature of apical division is speculative. Sections from apices indicate the newly formed cells are in a slightly domed series of uniform layers (fig. 24).

Spheroidal chambers, 70–120 μ in diameter, adjoining the adaxial leaf surface and frequently above a vein, were present in one apex (AC, figs. 20, 25) from the foliar disc to leaf bifurcation (AC, fig. 15). They result in slight to prominent bulges above the epidermis, but each cavity is apparently sealed by a layer of cuticle continuous with that of the epidermis (fig. 21). In no cases were they open to the exterior, even by degradation. Most chambers are devoid of contents; a few possessed small amounts of residue, and none exhibited internal structure.

Thin-walled cells delimit the remaining spheroidal space suggesting a structure of gaseous content. If air chambers, they may be analogous to a modified stomatal apparatus in which the stomatic cleft has permanently been roofed over with cuticle. Cavities are lacking or undiscernible elsewhere in the same and other stems, except in a few cases where they do not adjoin the epidermis, being separated by one to several cells (fig. 26, C). However, one lower stem fragment was characterized by lacunose areas.

ROOTS

Adventitious roots of S. *constrictum* are about 0.35 mm. in diameter, and their stelar size is denoted by the black endodermal ring (EN, fig. 17).

Delimitation of the root cortex from that of the stem is shown longitudinally in fig. 26. Figure 27 shows the root-stem vascular connection which is internodal even in such condensed articulations. Adventitious roots occurred singly or were abundant around branch bases. Branches up to the stage of development shown in figure 31 lack roots; this suggests the time sequence of root initiation. Roots emanated from branches in an adaxial to abaxial orientation, and remained singular or immediately bifurcated (figs. 32–33). Vascularization is near the main axis, but the root connection is with the branch and not at the node of the main axis. Adventitious roots were seen emanating from all parts of the stem except between leaves.

Larger roots were found attached to the axis in fig. 19. The root in fig. 16, 0.75 mm. in diameter, has two groups of uniformly small (12 μ) cells (5–6) near the center; from other sections the primary wood can not be described with certainty. Pitting of the secondary xylem is similar to that of the stem, but borders were not preserved (fig. 18). Periderm cells are 35–40 μ wide and compressed at their extremities merging with black amorphous tissue. Transversely, cells of the cortex are rectangular to polygonal and as large as 40 $\times$ 100 μ. Brown cellular contents typical of the cauline cortex are present.

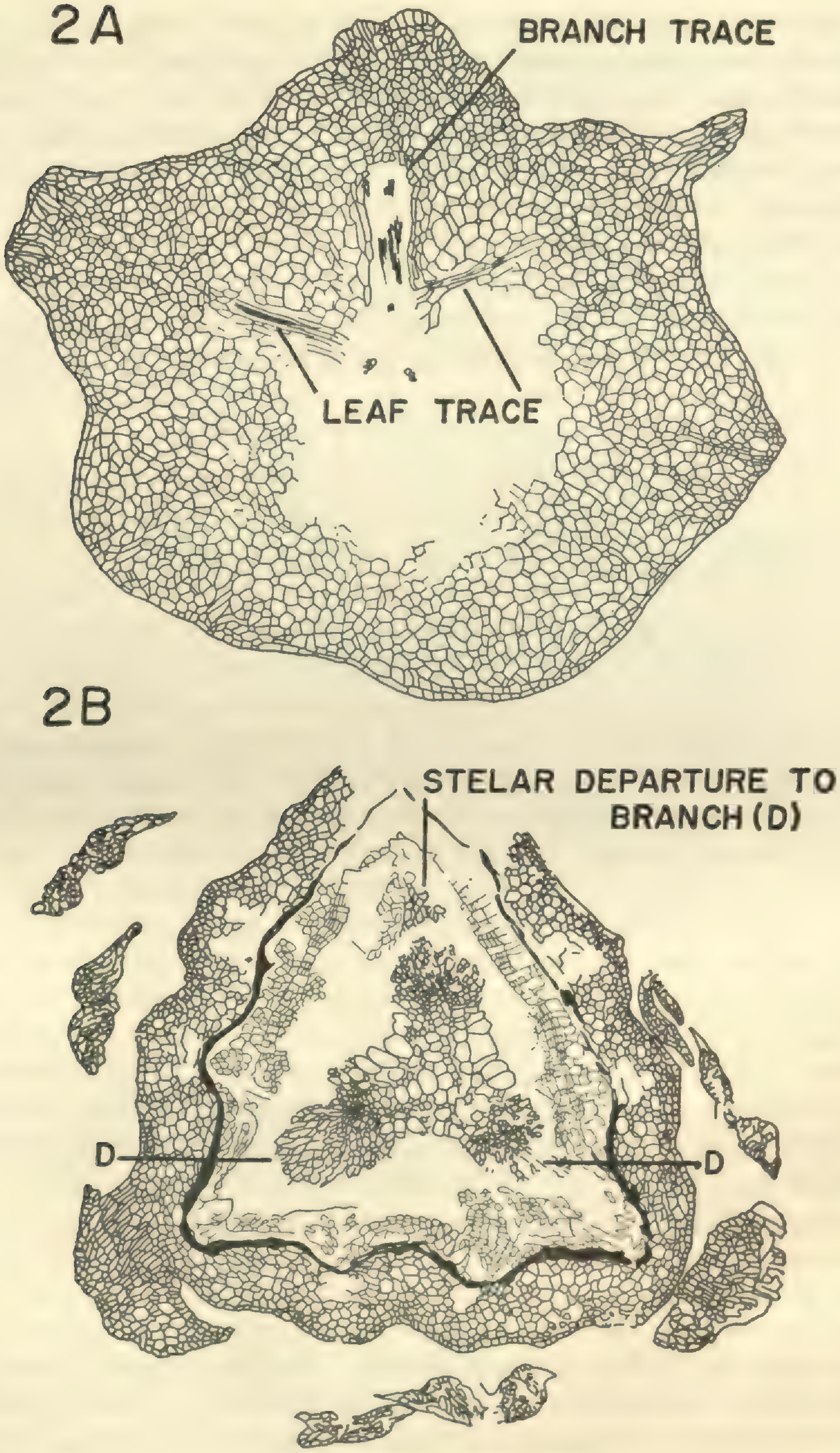
DISCUSSION

The cellular structure of the cortex and leaves of S. *constrictum* is quite distinct from that of other species; the cells are, throughout, uniformly thin-walled to a degree that suggests a plant of succulent habit. Although S. *Renaultii* and S. *plurifoliatum* have thin-walled inner cortical tissue, other differences between the two and S. *constrictum* are quite noticeable. Also, the ratio of cortical to xylary tissue in young stems is conspicuously greater than for other species.

The nodal diameter of S. *constrictum*, 4.5–5.0 mm., is comparable with those of S. *plurifoliatum* (4–6 mm.), S. *Renaultii* (3.6 mm.), and S. *Stephanense* (4.0–5.5 mm. S. *Renaultii* is the only petrified species with a smaller internodal diameter (2.2 mm.) than S. *constrictum* (2.5 mm.). The nodes of S. *constrictum* are 2.0 mm. apart, markedly less than S. *Renaultii* (6–7 mm.) or S. *Stephanense* (10 mm.).

A perpendicular bisect of the primary wood in S. *constrictum* is 0.2–0.3 mm. compared to 0.4 mm. in S. *plurifoliatum* (Baxter 1948) and 1.0 mm. in S. *insigne* (Bower 1930). In addition to smaller size, the primary xylem in S. *constrictum* is very subject to degradation and crushing.

Sphenophyllum, in general, displays a distinctive leaf trace pattern, and S. *constrictum*, with three dichotomized V-traces, represents one of the simplest types. One or more traces may enter the leaf base in *Sphenophyllum*, with the number of terminal vein divisions usually coinciding with foliar segments or dentations (Renault 1882). Each leaf of S. *constrictum* has two ultimate veins



Text Figure 2. Nodal transverse sections with branch origins.
2A, *Sphenophyllum constrictum* (Slide 2730); 2B, *S. plurifoliatum* (Slide 1539). ×17.5.

and is bifid. Dichotomized foliar segments and venation are common in *Sphenophyllum* but not to the diminutive extent as in *S. constrictum*. Of the eighteen compression species recognized by Abbott (1958) from the United States and Canada, *S. fasciculatum* (Lesquereux) D. White has the most similar leaves in size and form (six bifid leaves 1–4 mm. long). *S. fasciculatum* also exhibits frequent branching and is known only from the middle-Pennsylvanian (Allegheny) of Missouri, Ohio, and Pennsylvania.

Nodal adventitious root connection has been reported in *S. insigne* (Scott 1920) and *S. Renaultii* (Renault 1878) but such attachment was not figured until Baxter (1948) found that roots occurred at any part of the stem in *S. plurifoliatum*. In *S. constrictum*, adventitious roots occur internodally but are most abundant in the vicinity of branch bases as in *S. plurifoliatum*.

The relative position of branch and leaves in *Sphenophyllum* has not been clear; Grand'Eury (1877) described branching as axillary; Solms-Laubach (1891) termed it obscure but axillary according to previous workers; Renault (1876; 1878) reported a branch between two adjacent leaves and also described an axillary swelling which he thought might be a bud, and later, in 1896, he described branching as extra-axillary, with some branches exhibiting a sort of dichotomy.

Detailed and illustrative evidence was first presented by Baxter (1948) showing three branches arising from a node of *S. plurifoliatum*. According to Baxter, branch origins were between adjacent leaves. Slides 1538–1542 representing the serial branching sequence indicate there were subtending leaves preserved at two of the three branch vertices. Text figure 2B (from slide 1539 referrable to fig. 19, *pl. 15*, Baxter 1948) shows a nodal cross-section with remnants of eight leaves, two opposite each side of the stem and indicative of one at each angle. In such an interpretation, there are nine leaves in this form of *S. plurifoliatum*, and each of the three branches arose directly above a leaf. In *S. constrictum* the branches arose in a variable relationship with two associated leaves, from directly above a leaf (text fig. 2A) to above and between the two leaves. Text figure 2A shows five leaf bases with that of a branch above the sixth subtending leaf. In summary, the evidence available at present suggests that branches in *Sphenophyllum* may originate directly above a leaf or above and between two leaves.

The suggested habit of Sphenophylla ranges from suffrutescent herbs to lianas with an aquatic to terrestrial habitat. Hydrophytes have been repeatedly ruled out, and the genus has been considered ecologically as a whole because the anatomy was essentially similar. Previous species lacked the aerenchymatous tissue usually found in aquatics (Podostemaceae excepted). On the contrary, Sphenophylla exhibited a thick-walled outer cortex, leaves reinforced by sclerotic cells with substantial epidermal thickening, and well developed, extensive vascular tissue; all are indicative of a plant adapted to land (Reed 1949). Size and habit from compression forms, some with dorsi-ventral verticils, further substantiated a scrambling or climbing liana.

In S. *constrictum*, epidermal and cortical tissue is thin-walled, and development of wood is more meager than in other species. Though the nature of chambers in the apical portion is dubious, the cortical structure of a lower stem fragment is lacunose. Such evidence infers a semi-aquatic habitat. Lack of mesophyll differentiation and limited cuticular development conform with such an inference (Arber 1920). The abundant thin walled cortical tissue, short internodes, and forked needle-like leaves suggest a succulent plant, though the epidermal walls are relatively thin and the cuticle scant. The character of peripheral cellular contents of the plant would also have a bearing on water retention or loss (Maksimov 1929), but the nature or significance of the characteristic cellular residue in stem and leaf is only conjectural.

Stems of described Sphenophylla probably were aerial, but it is likely that basal anchoring was frequently submerged in their swampy environment (Arnold 1947). Divergence in habitat of S. *constrictum*, indicated by anatomy and habit, from the contemporary coal ball species, S. *plurifoliatum*, may not be as drastic then as first envisioned. Both species were found in the same coal balls, though the former was better preserved.

Rhizonium verticillatum Williamson (1889), of the heterogeneous root genus established by Corda (1845), is strikingly similar to S. *constrictum*. An examination of slides 1234 and 1909 (Williamson Collection) confirms Williamson's descriptions and figures (162–3, figs. 16–21, 1889); however, the axes are those of stems with verticillate leaves rather than of roots with rootlets. Seven nodes are shown in longitudinal section, 1.6 mm. apart, 1.5 mm. in nodal diameter, and 1.2 mm. internodally. The metaxylem of the triarch exarch protostele is clearly scalariform and distinctly different from that of S. *constrictum*. A perpendicular bisect of the xylem is 0.14–0.18 mm.; there are no secondary tissues. Indistinct tissue surrounding the xylem adjoins the parenchymatous cortex which is thin-walled, the outermost cells (2–3) slightly thicker, homogeneous, and continuous with that of the leaves; this was apparently succulent in nature and remarkably like that of S. *constrictum*. Amber colored cellular residue is lacking. The leaves are about 1.5 mm. in length, but the actual number and nature of their tips can not be determined from the thin sections. *R. verticillatum* apparently represents a form of *Sphenophyllum* previously overlooked in the Coal-Measures of England and is quite similar to S. *constrictum* from American coal fields.

SPHENOPHYLLUM **constrictum** Phillips, sp. nov.

Diagnosis: Articulated stem, 4.5–5.0 mm. nodal diameter (less than 6.0 mm.), 2.5 mm. internodal diameter, 2.0 mm. between nodes; exarch, triarch protostele, primary bisect 0.2–0.3 mm., metaxylem pitting scalariform-reticulate; tracheids of secondary wood radial to protoxylem often show little distinction from others in size, pitting bordered-reticulate; compact internal periderm bordered by black amorphous tissue; cortex and epidermis of thin parenchymatous tissue with dark residual contents, cortex of lower stem lacunose, air chambers scant elsewhere; cuticle thin or absent.

Leaves six in each verticil, not over 1.5 mm. long, bases fused and bifid in distal portion, circular to ellipsoidal in cross-section, cellular structure continuous with that of cortex, probably succulent in life; vascular supply initiates as 3 V-traces which divide in cortex to 12 with one strand entering each bifid segment.

Lateral branches originate above leaf or above and between leaves.

Adventitious roots, 0.35–0.75 mm. diameter, primary xylem not determined, rectangular to polygonal cortical cells with characteristic cauline contents, secondary tissue similar to stem, attachment internodal to vicinity of node.

Holotype: Slides 2641–2790 from WCB# 1026, paleobotanical collections of The Henry Shaw School of Botany, Washington University.
Locality: Hallowell-West Mineral, Cherokee County, Kansas
Horizon: Fleming, Des Moines Series, middle-Pennsylvanian
Paratypes: Slides 2791–2829 and WCB# 921-2-3A-3B
Locality: North of Booneville, Warrick County, Indiana
Horizon: Petersburg V, middle-Pennsylvanian
Paratypes: Slides 2830–2910 and WCB# 1025 D-E-F
Locality and Horizon of Holotype.

Summary

Developmental stages, including lower stem and apical portions, of a new vegetative shoot system, *Sphenophyllum constrictum*, were described from the middle-Pennsylvanian of Indiana and Kansas. Branch origins were found to be directly above to above and between leaves and adventitious roots emanated internodally to nodally, more frequently at branch bases. The following features of *Sphenophyllum* were exhibited by the new species.

1. Exarch triarch protostele.
2. Six sessile superposed verticillate leaves supplied with dichotomized V-traces.
3. Compact periderm and secondary xylem with intercellular spaces at truncate tracheidal margins and reticulate bordered pitting.

The following different characters easily distinguish S. *constrictum*:

1. Epidermal and cortical tissue consists of thin-walled cells with dark residual contents; lower stem with lacunose cortex. The cortex of stems without secondary growth constitutes as much as four-fifths of the diameter.
2. The leaf supplies are derived from three dichotomized V-traces which give rise to twelve veins, two per leaf, one for each bifid segment.
3. The six bifid leaves are 1.5 mm. or less in length from a foliar disc 4.5–5.0 mm. in diameter, with internodal diameter of 2.5 mm. and 2.0 mm. between nodes; the constricted outline is evident in all but transverse sections and decorticated material.

Acknowledgments

This research was originated and guided by Dr. Henry N. Andrews as one phase of a research program aided in large part by a grant from the National Science Foundation. Special thanks are given to Dr. Sergius H. Mamay, U. S. Geological Survey, and Dr. Robert W. Baxter, University of Kansas, who generously extended the use of their facilities and materials, and to Mr. F. M. Wonnacott, British Museum (Natural History), for the prompt loan of slides from the Williamson Collection.

Appendix

Renault referred to *S. quadrifidum* Renault (non Brongniart) both as a species and subspecies, (*S. angustifolium* (Germar) Goeppert subsp. *quadrifidum* Renault), although the latter never appeared as a combination. A new specific epithet is proposed with the below listed type description citation and subsequent illustrative references:

Sphenophyllum **Renaultii** Phillips nom. nov.

1876 *Sphenophyllum quadrifidum* B. Ren., Végétaux Silicifiés d'Autun et de Saint-Étienne, Nouvelles Recherches sur la Structure des Sphenophyllum et sur Leurs Affinités Botaniques, Annals des Sciences Naturelles, sér. 6, Botaniques, 4:293–299, *pl. 7*, figs. 1–3, non Brongniart, 1828, Prodrome d'une Histoire des Végétaux Fossiles, p., 76 (68).
1878 S. *quadrifidum* in Renault, Recherches sur la Structure et les Affinités Botaniques des Végétaux Silicifiés, Autun, 178–183, *pl. 28*, figs. 1–2.
1880 S. *quadrifidum* in Schimper, in Zittel, Handb. Paläont., 177, Fig. 134, 1–3.
1882 S. *quadrifidum* in Renault, Cours de Botanique Fossile, 2:89, 93–97, *pl. 15*, figs. 1–3.
1887 S. *quadrifidum* in Solms-Laubach, Einl. Paläophyt., 356, Fig. 48, 1–3.
1891 S. *quadrifidum* in Solms-Laubach, Fossil Botany, Oxford, 347, text fig. 48, 1–3.
1900 S. *quadrifidum* in Scott, Studies Foss. Bot., 83, text fig. 34; 2d ed., 1908, 1:80, text. fig. 36; 3d ed., 1920, 1:79, text fig. 38.
1927 S. *quadrifidum* in Hirmer, Handb. Paläobotanik, 351, 353, Fig. 410.
1940 S. *quadrifidum* in Walton, Intro. Foss. Plants, 69, text fig. 43; 2d ed., 1953, 73, text fig. 43.

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Explanation of Plate

PLATE 1

Sphenophyllum constrictum sp. nov.

Figure 1. Transverse section of mature stem from Kansas. MX, metaxylem; PD, periderm; C, cortex.
Slide 2856 × 35 IX

Figure 2. Transverse section of mature stem from Indiana. PX, protoxylem; SX, secondary xylem; AT, amorphous black tissue between periderm and C, cortex.
Slide 2800 × 35 VII

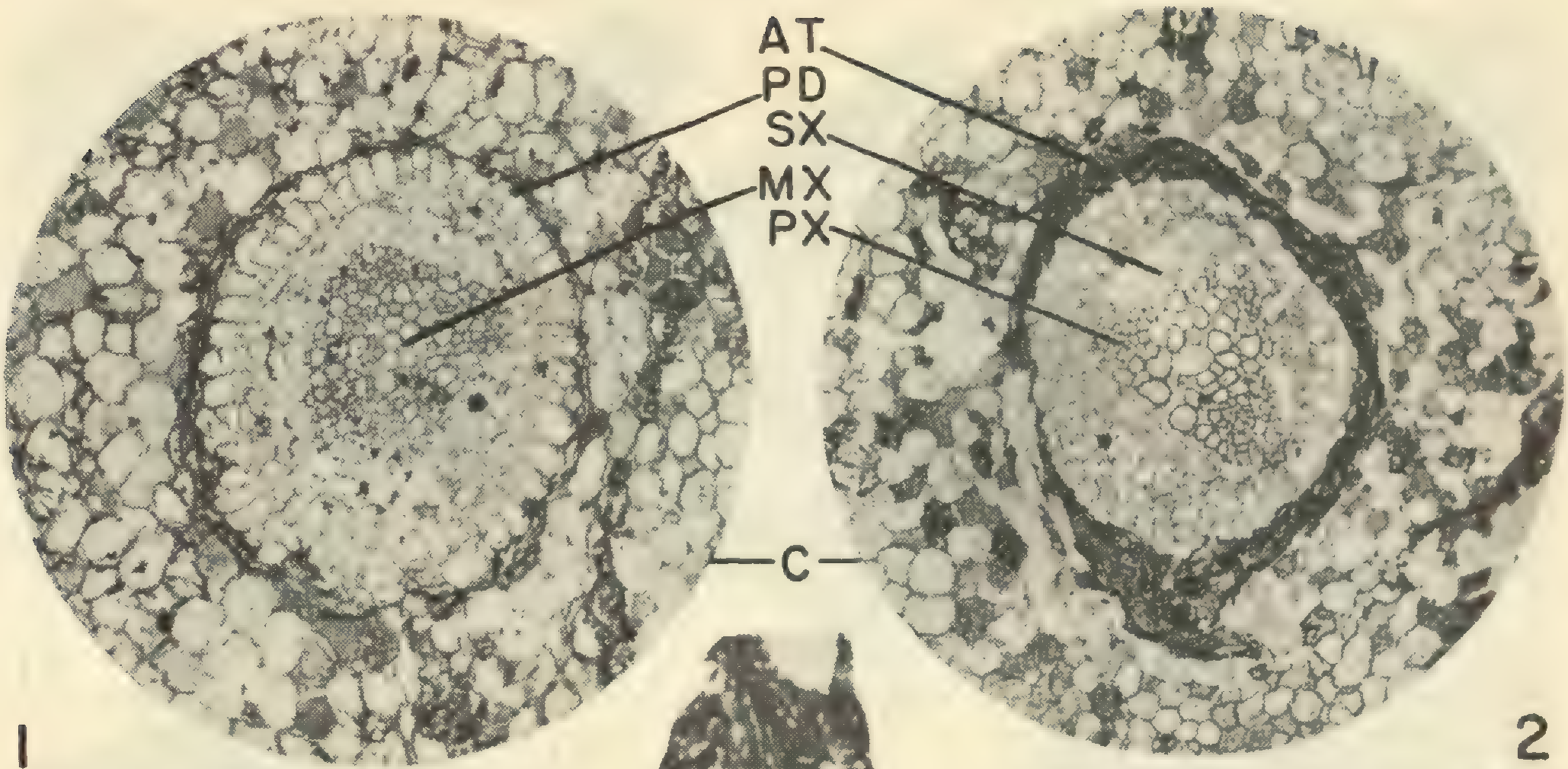
Figure 3. Enlarged longitudinal section of mature stem shown in fig. 4. PH, possible phloem; AT, amorphous black tissue; C, primary cortex.
Slide 2797 × 58 VI

Figure 4. Longitudinal section of mature stem showing four nodes, from Indiana.
Slide 2797 × 7 VI

Figure 5. Enlarged longitudinal section of mature stem shown in fig. 4. PX, protoxylem; MX, metaxylem; AT, amorphous black tissue.
Slide 2797 × 58 VI

Figure 6. Transverse section of stem. PC, spaces at the truncate margins of secondary xylem indicating unpreserved parenchyma; PD, periderm; AT, amorphous black tissue; C, vestiges of sloughed off cortex.
Slide 2796 × 22 VI

Figure 7. Oblique transverse section of main axis, A, and branch, B. Note the residual cellular content pattern and the stelar development.
Slide 2805 × 9 VII



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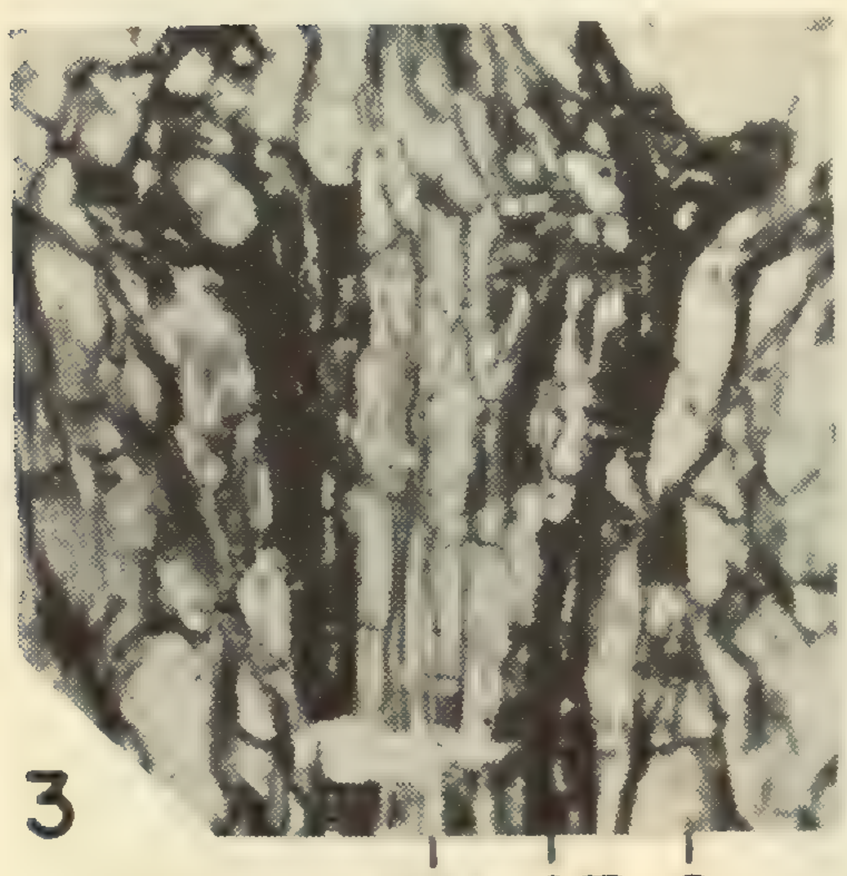

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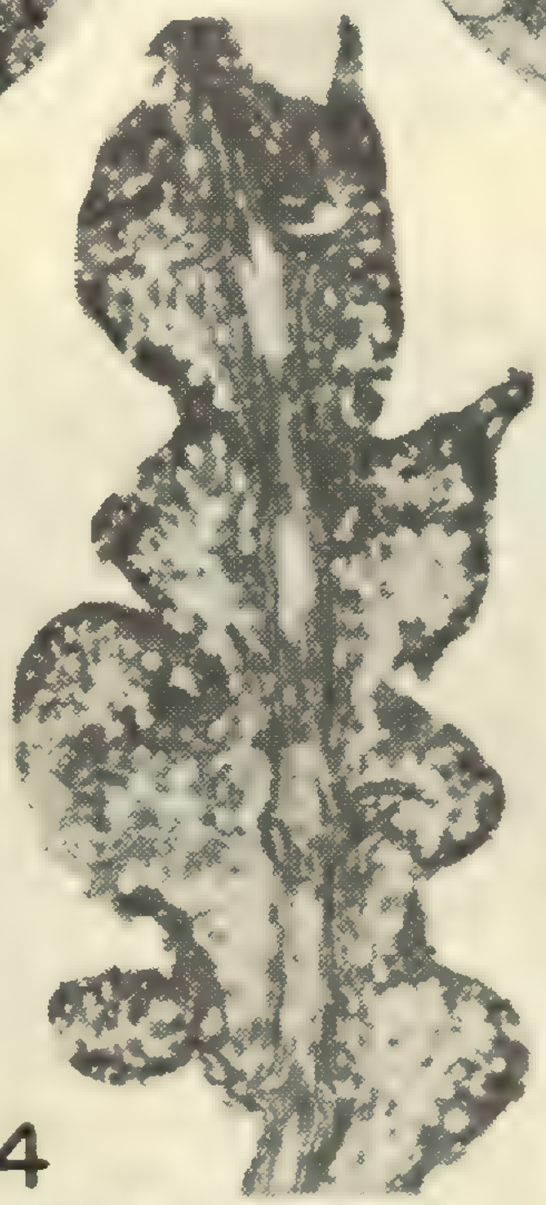

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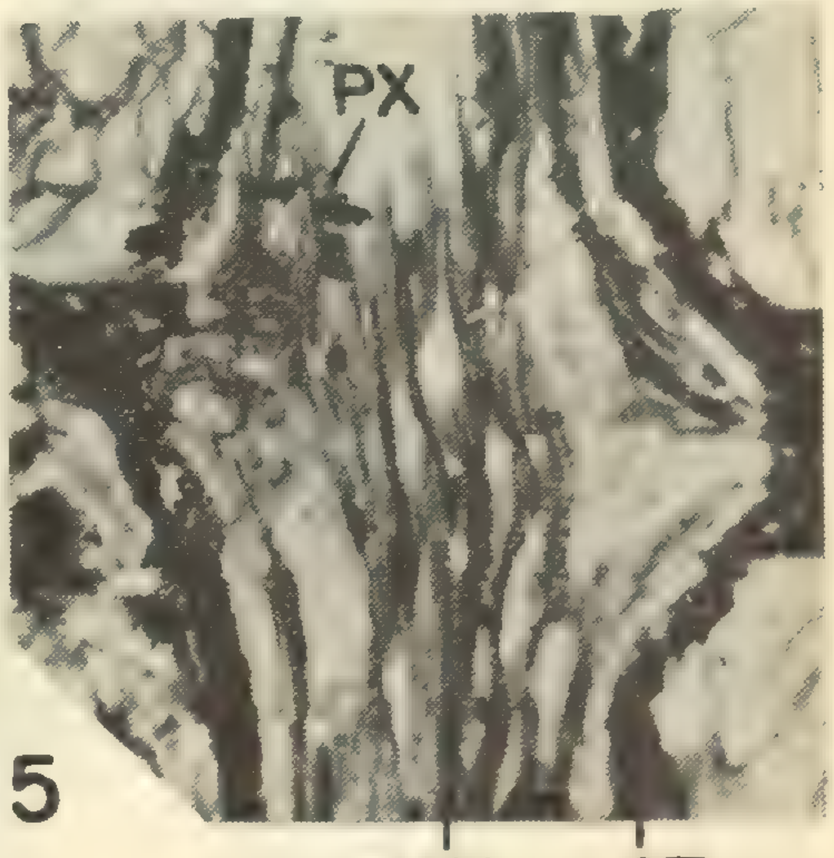

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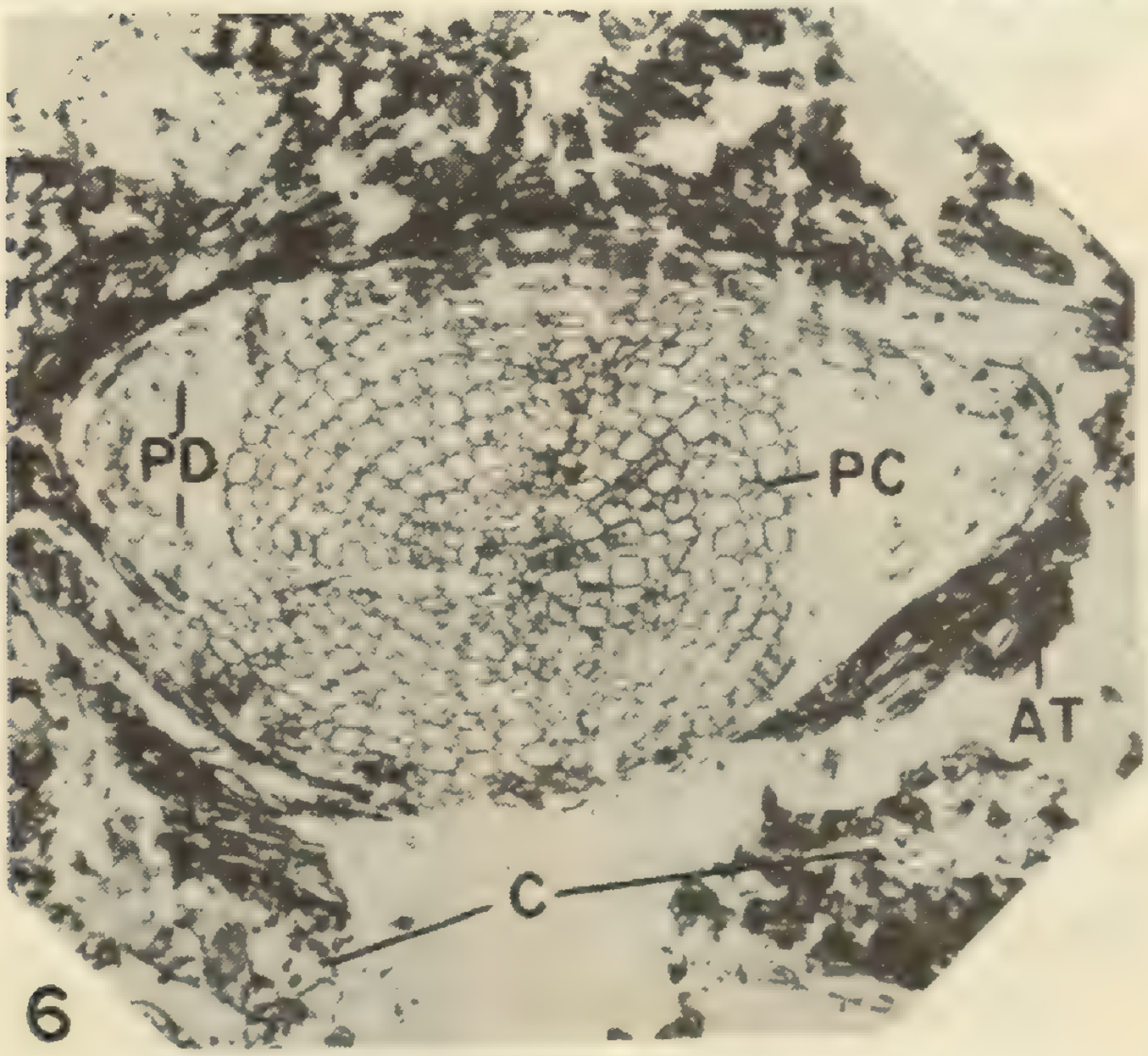

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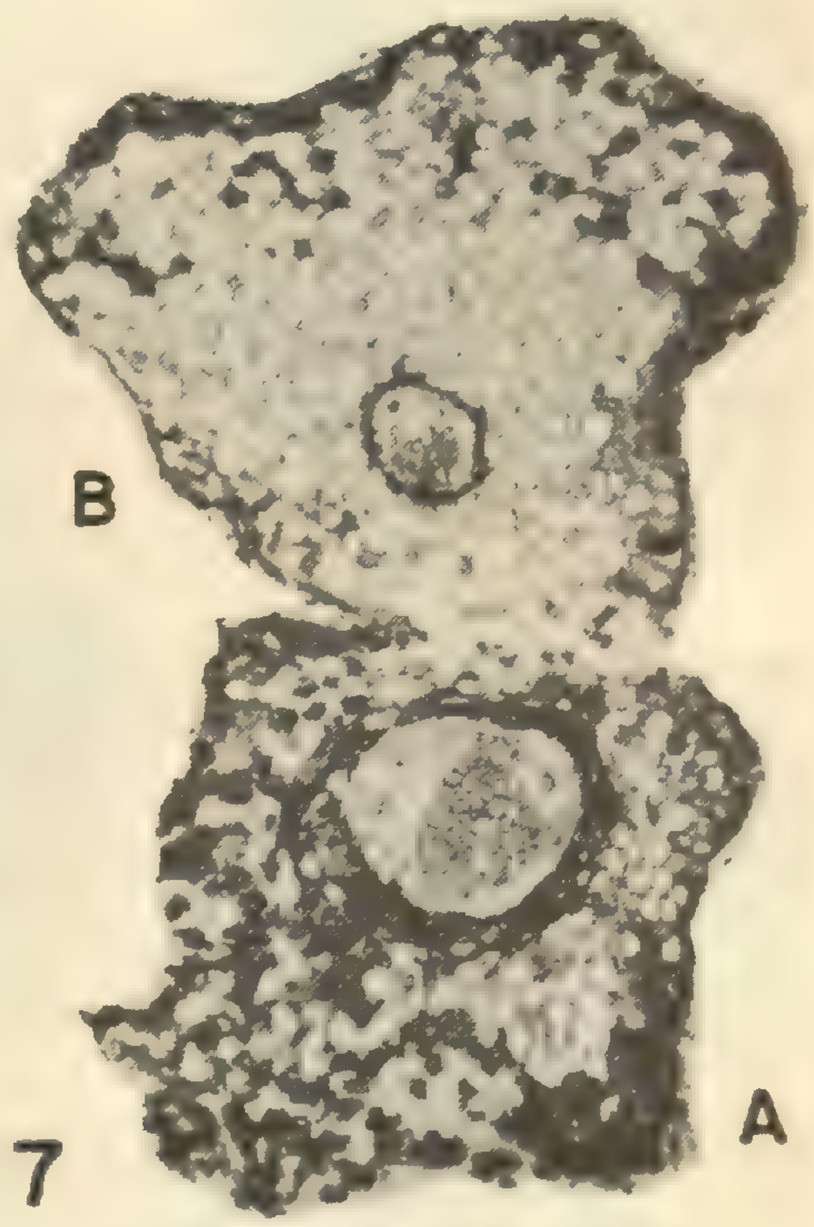

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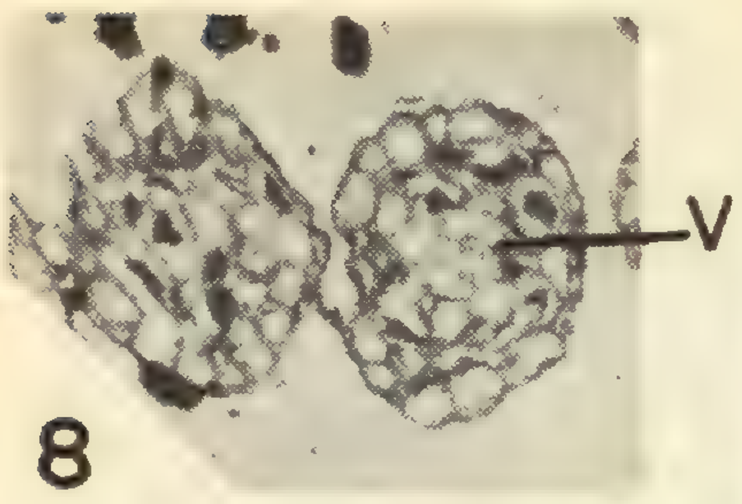
PHILLIPS—SPHENOPHYLLUM CONSTRICTUM



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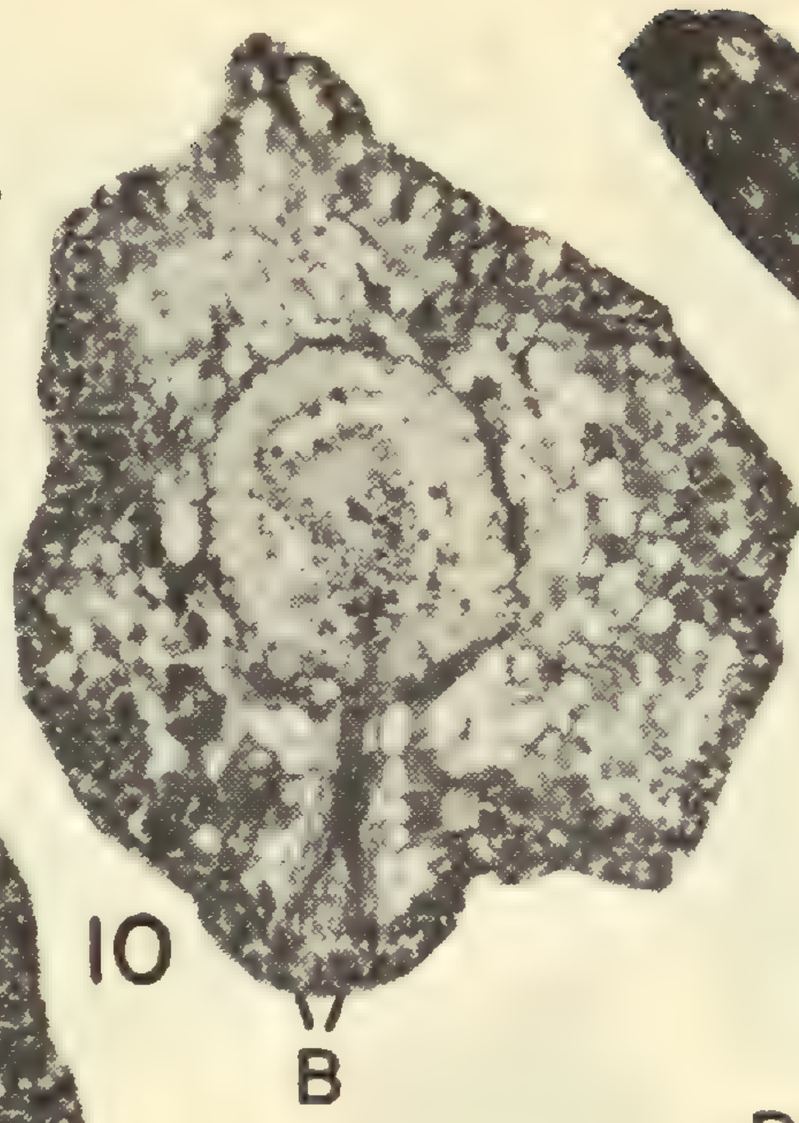

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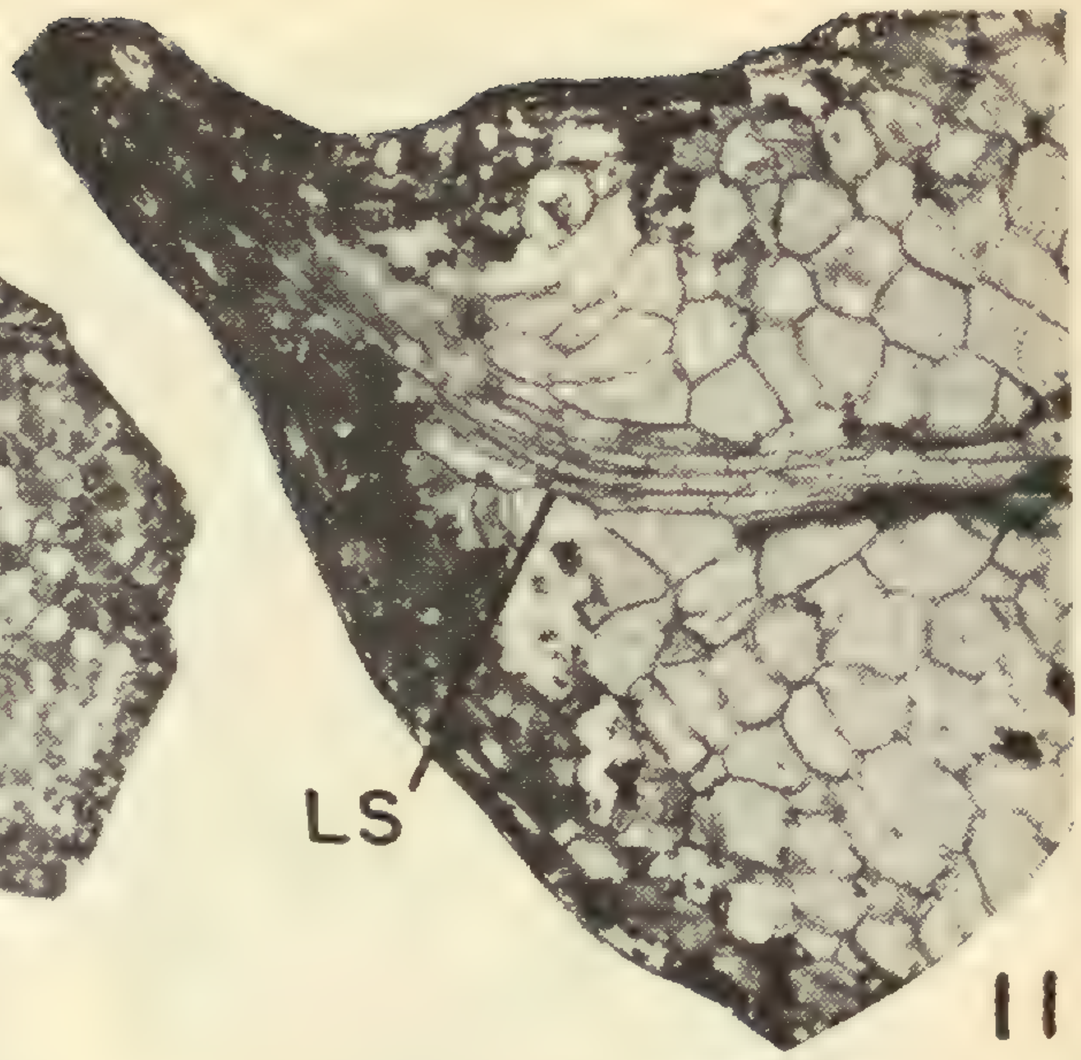

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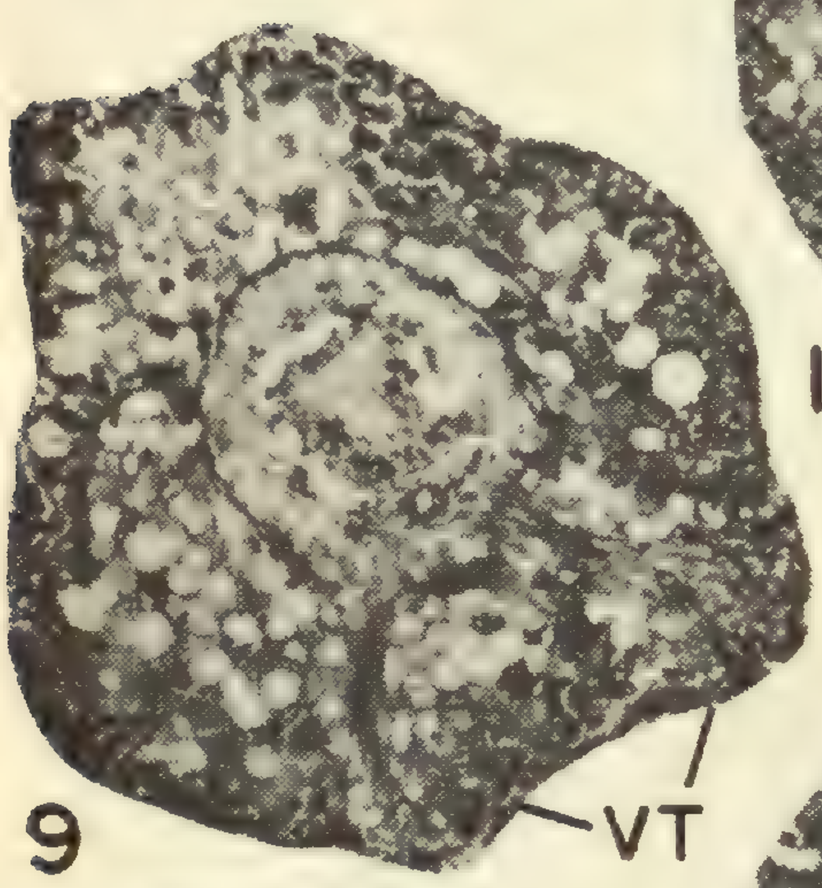

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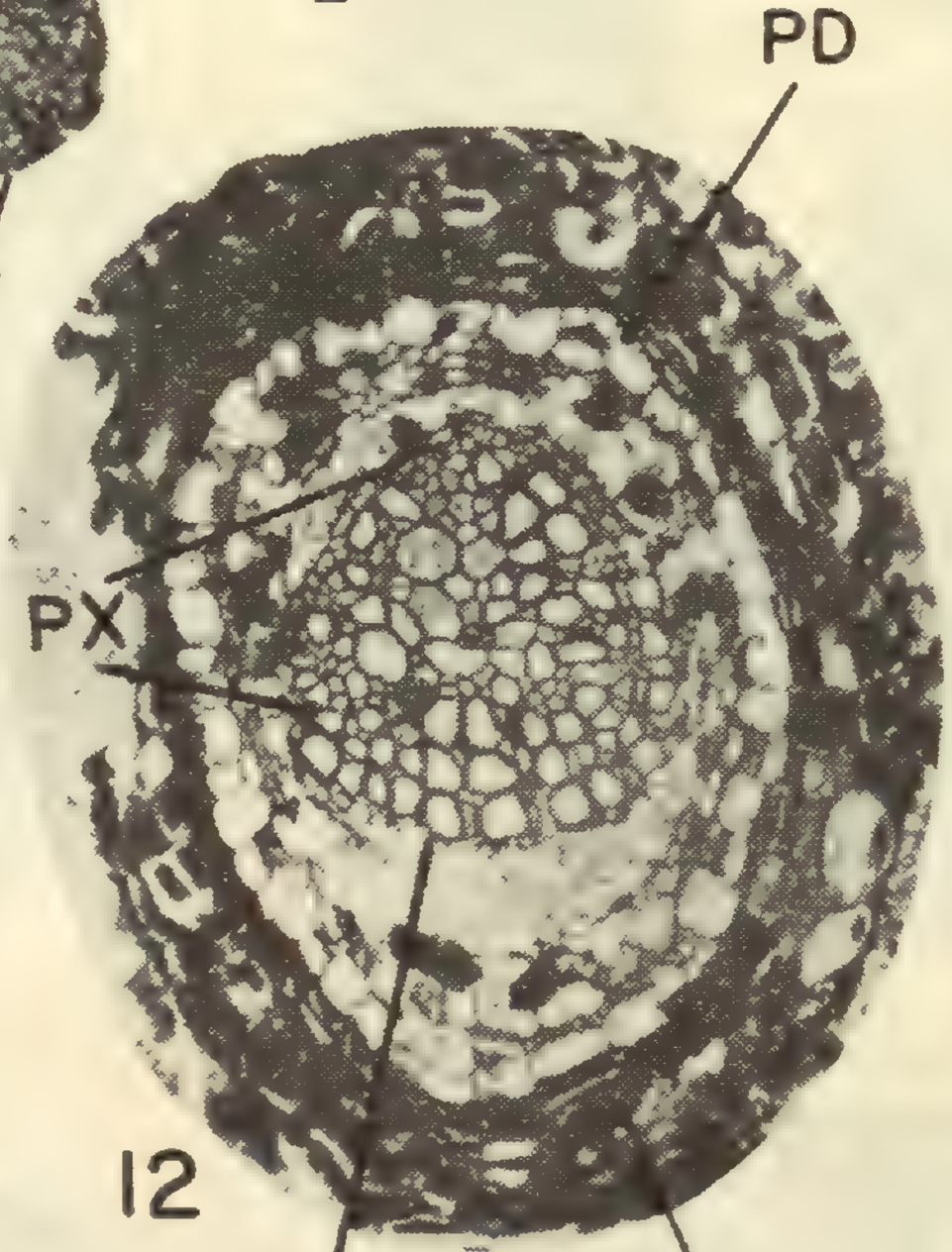

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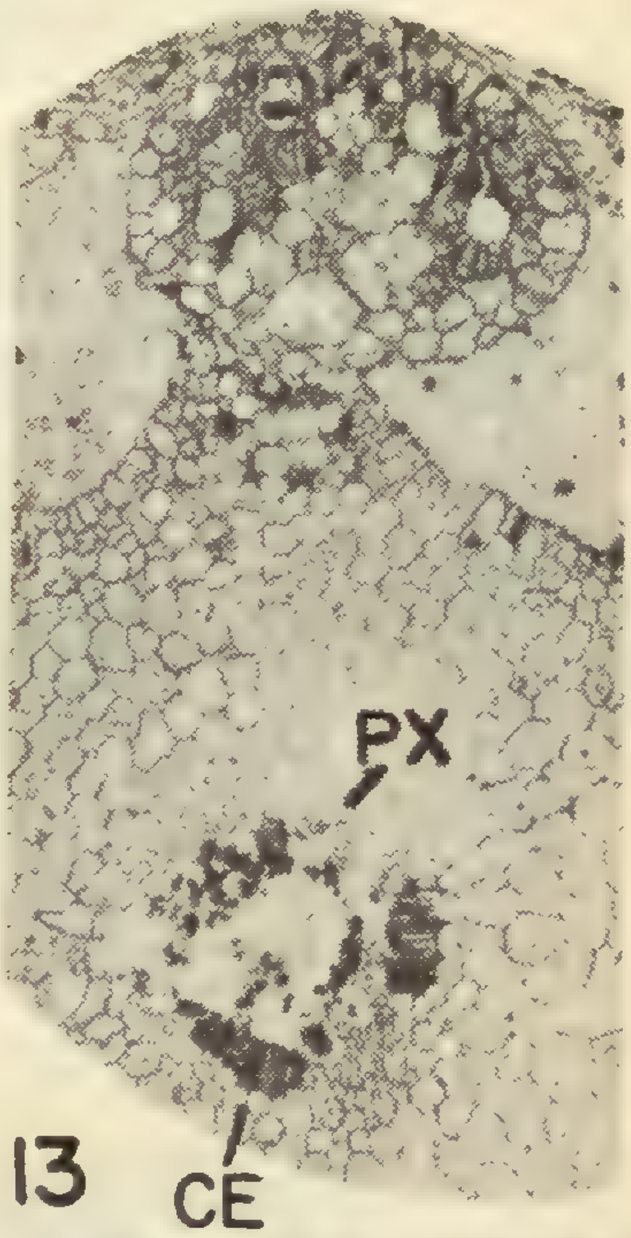

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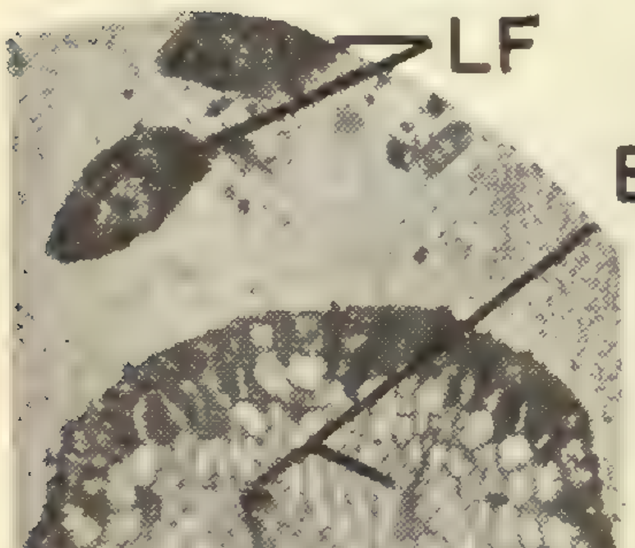

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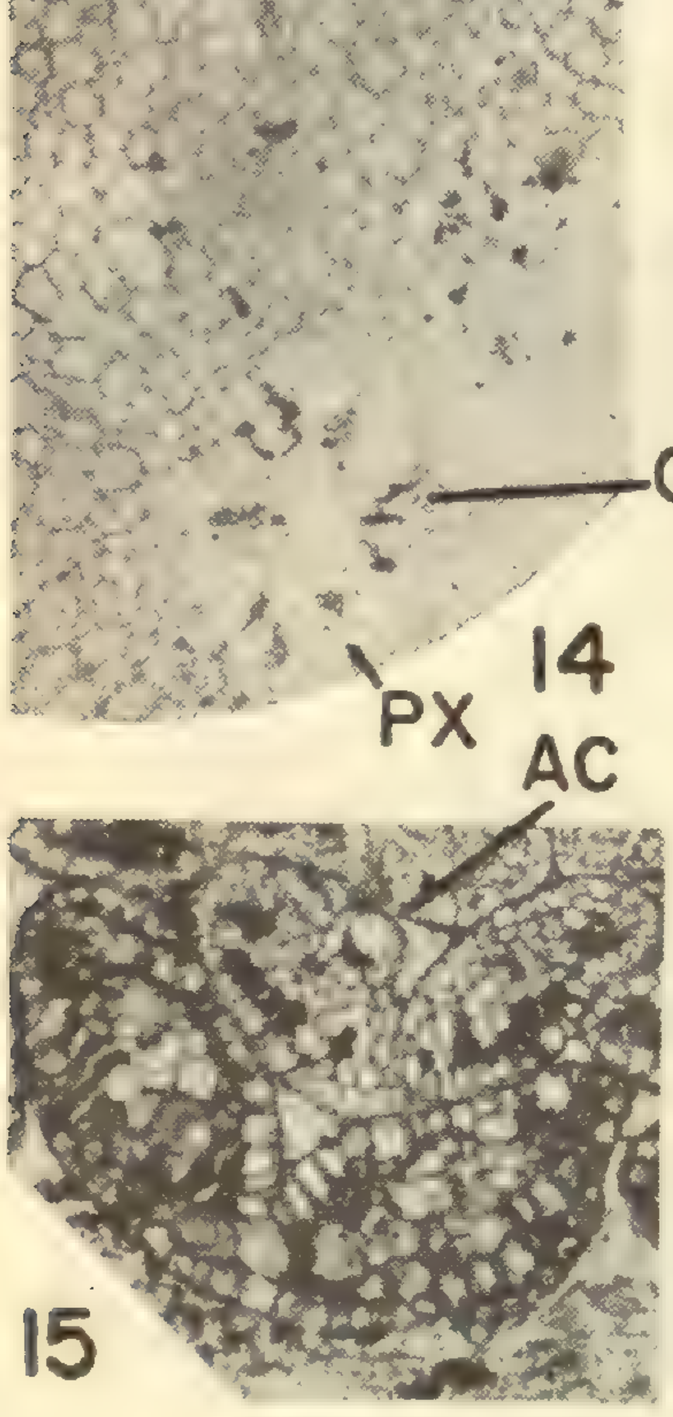

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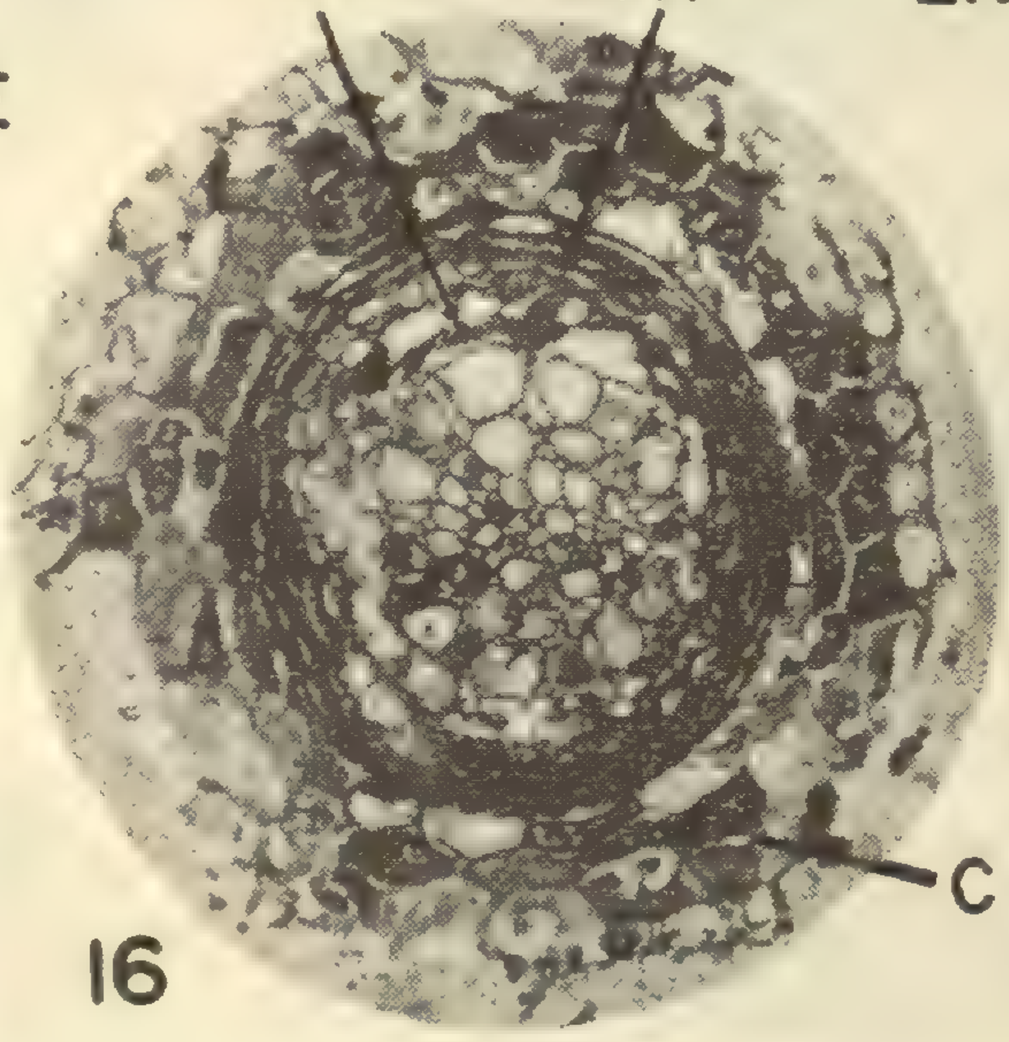

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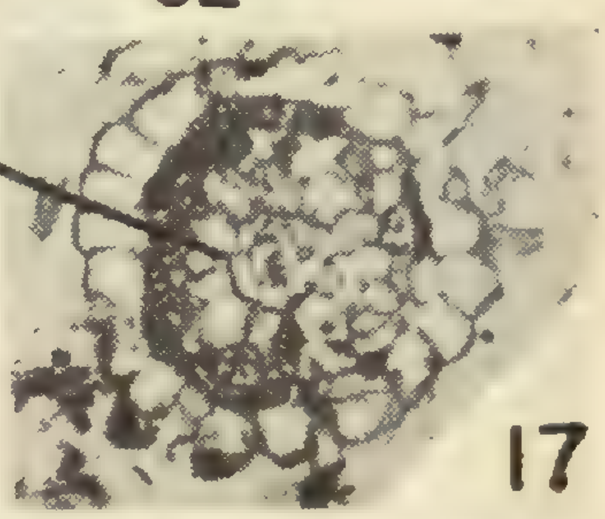

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Explanation of Plate

PLATE 2

Sphenophyllum constrictum sp. nov.

Figure 8. Transverse section of the two tips of a leaf taken from the apex. V, vein.
Slide 2723 × 112 I

Figure 9. Transverse section of mature stem. VT, V-trace or twin traces passing through the periderm, black amorphous tissue, and cortex.
Slide 2856 × 18 IX

Figure 10. Serial peel sequence of figure 9; B, one leaf trace of V-trace divided into two veins.
Slide 2856 × 18 IX

Figure 11. Enlarged longitudinal section of leaf of figure 26, upper left. LT, elongated conducting elements. Note undifferentiated mesophyll of leaf and leaf base.
Slide 2761 × 35 III

Figure 12. Transverse section of a decorticated branch. PX, protoxylem; PD, periderm; AT, black amorphous tissue, SX, secondary xylem. Note unequal development of secondary xylem.
Slide 2799 × 63 VII

Figure 13. Sector of oblique transverse section from young stem showing a leaf almost separated from the foliar disc. PX, protoxylem; CE, tissue referrable to that in figs. 14, 22.
Slide 2708 × 35 I

Figure 14. Sector of transverse section from young stem. LF, two tips of a leaf from node below; B, two veins cut tangentially in leaf base; CE, tissue of uncertain nature which alternates with the protoxylem, PX.
Slide 2739 × 35 II

Figure 15. Oblique transverse section from apex. Two superposed bifurcating leaves from successive nodes. AC, chamber bulging out on upper epidermal leaf surface.
Slide 2717 × 63 I

Figure 16. Transverse section of mature root. SX, secondary wood; AT, amorphous black tissue; C, cortex.
Slide 2762 × 63 IV

Figure 17. Transverse section of young adventitious root. EN, endodermal ring.
Slide 2879 × 58 VIII

Figure 18. Oblique longitudinal section of mature root showing reticulate pitting of the secondary xylem.
Slide 2760 × 63 IV

Explanation of Plate

PLATE 3

Sphenophyllum constrictum sp. nov.

Figure 19. Oblique transverse section of the lower stem. L, lacunae of the primary cortex.
Slide 2757 × 12 IV

Figure 20. Oblique transverse section from apex of stem shown in figs. 28–30. MR, young cells near the meristematic region; AC, two of three chambers shown adjoining the upper epidermis of the leaf.
Slide 2715 × 35 I

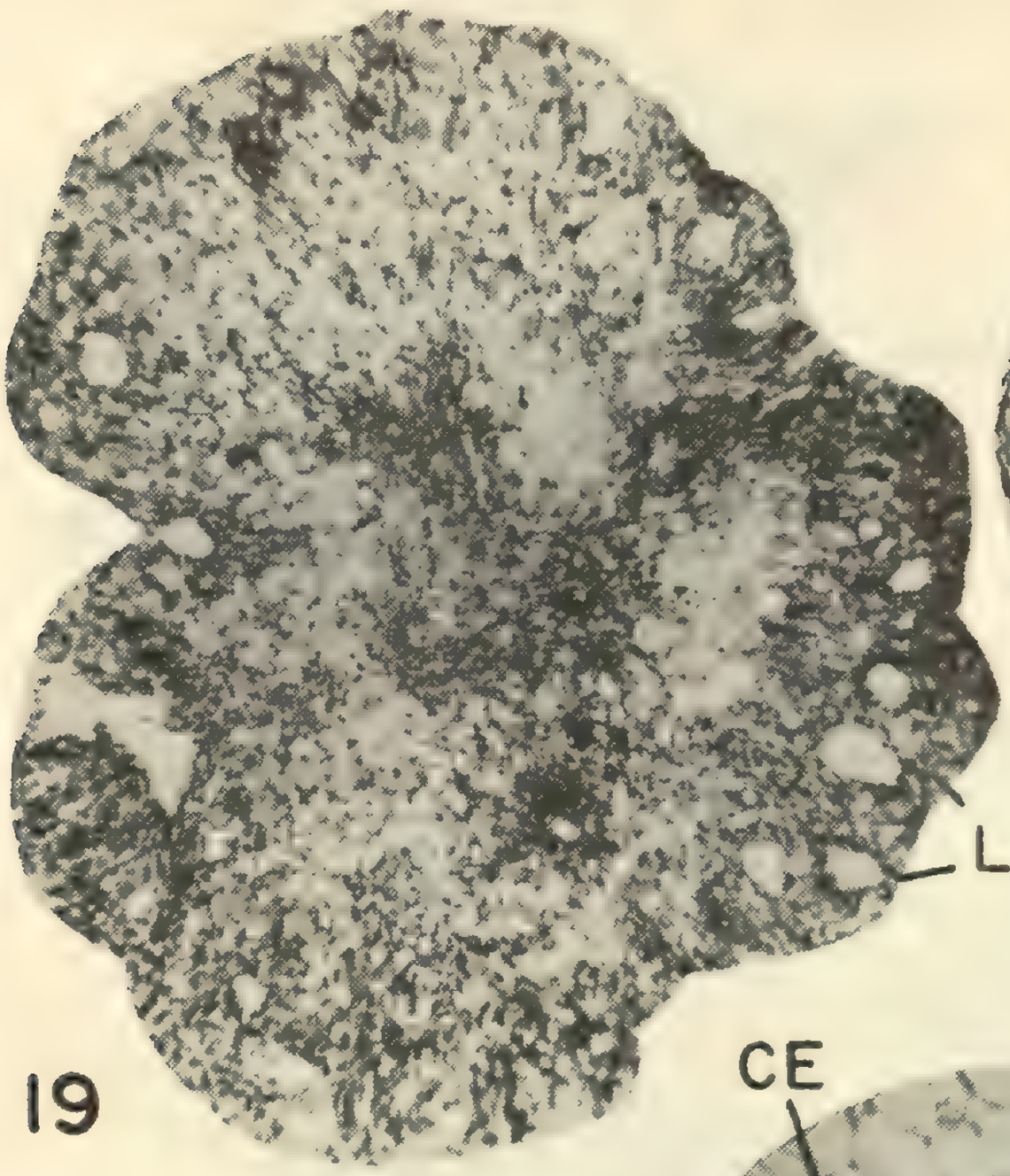
Figure 21. Oblique transverse section through a chamber, AC, on the upper epidermis of a leaf. The chamber is roofed over by cuticle.
Slide 2718 × 63 I

Figure 22. Transverse section of stem near apex. PX, one preserved protoxylem group; CE, groups of cells with brown residual content; note they alternate with protoxylem groups.
Slide 2695 × 58 I

Figure 23. Transverse section of lower epidermis or epidermis of leaf base. ST, perhaps a stoma with cutinized guard cells on each side and the thickened recurved margin of a guard cell behind.
Slide 2745 × 112 III

Figure 24. Longitudinal section of nascent branch directly above a leaf indicated by LT, leaf trace. Enclosed by three primordal leaves is the meristematic region, MR. Enlargement of B, fig. 28.
Slide 2659 × 35 I

Figure 25. Serial sequence 0.7 mm. above fig. 20 in apex showing young leaves. AC, chamber on upper epidermis.
Slide 2720 × 35 I



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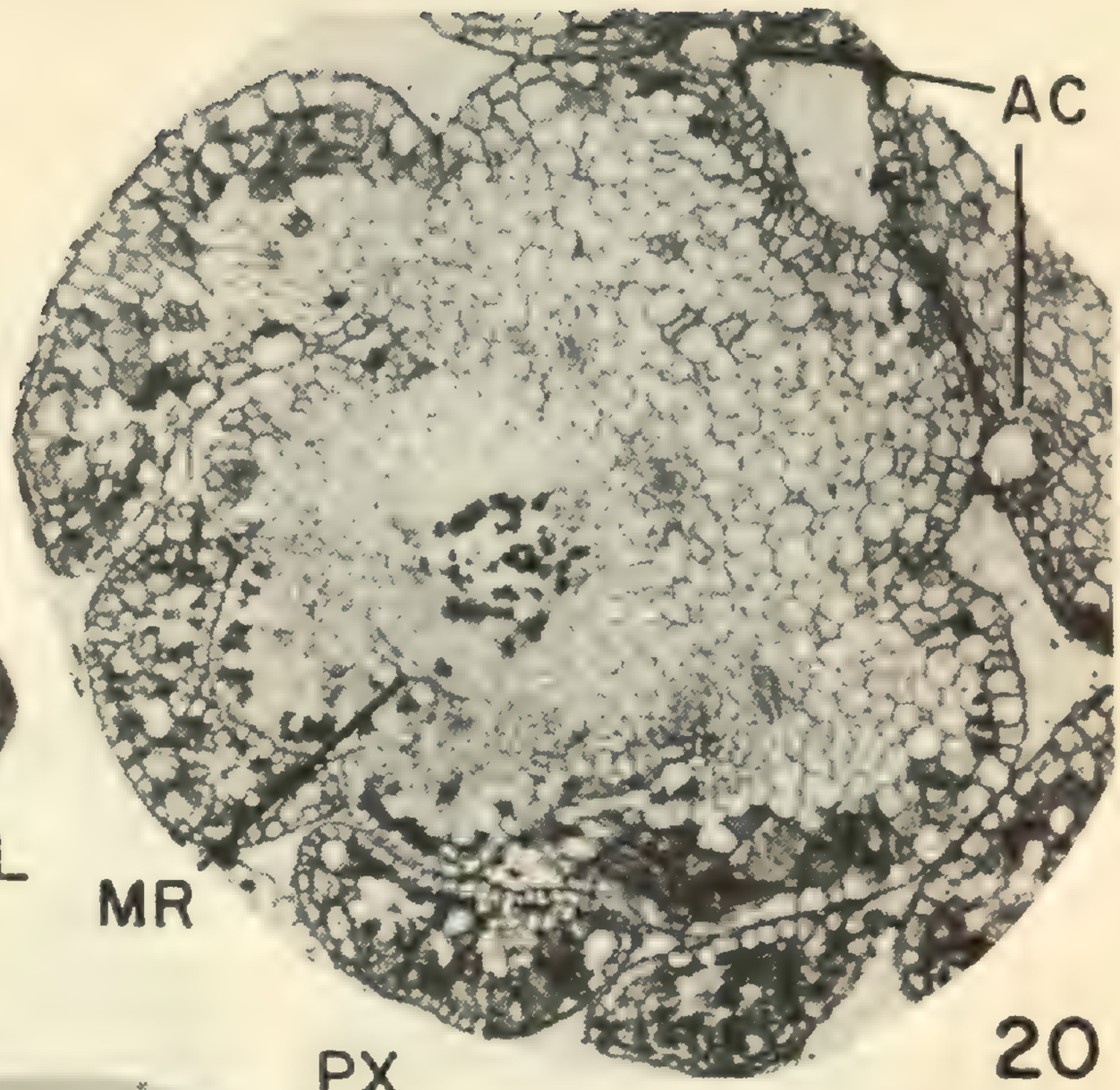

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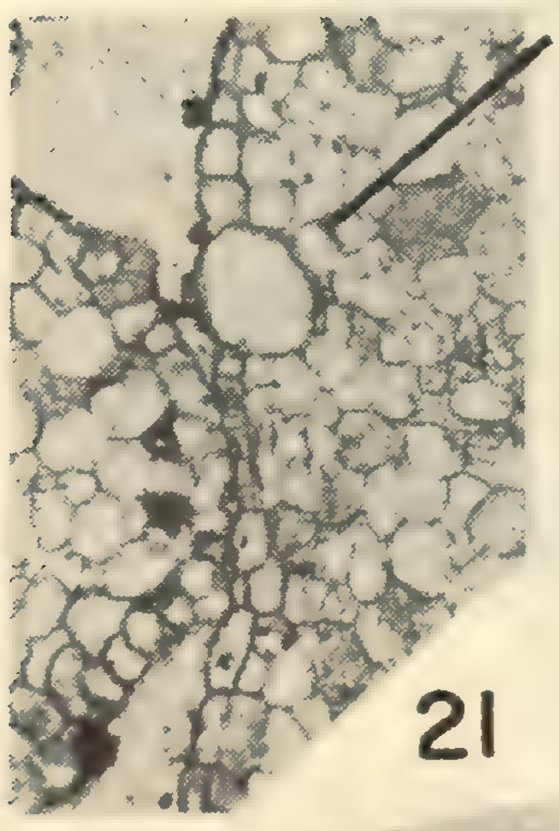

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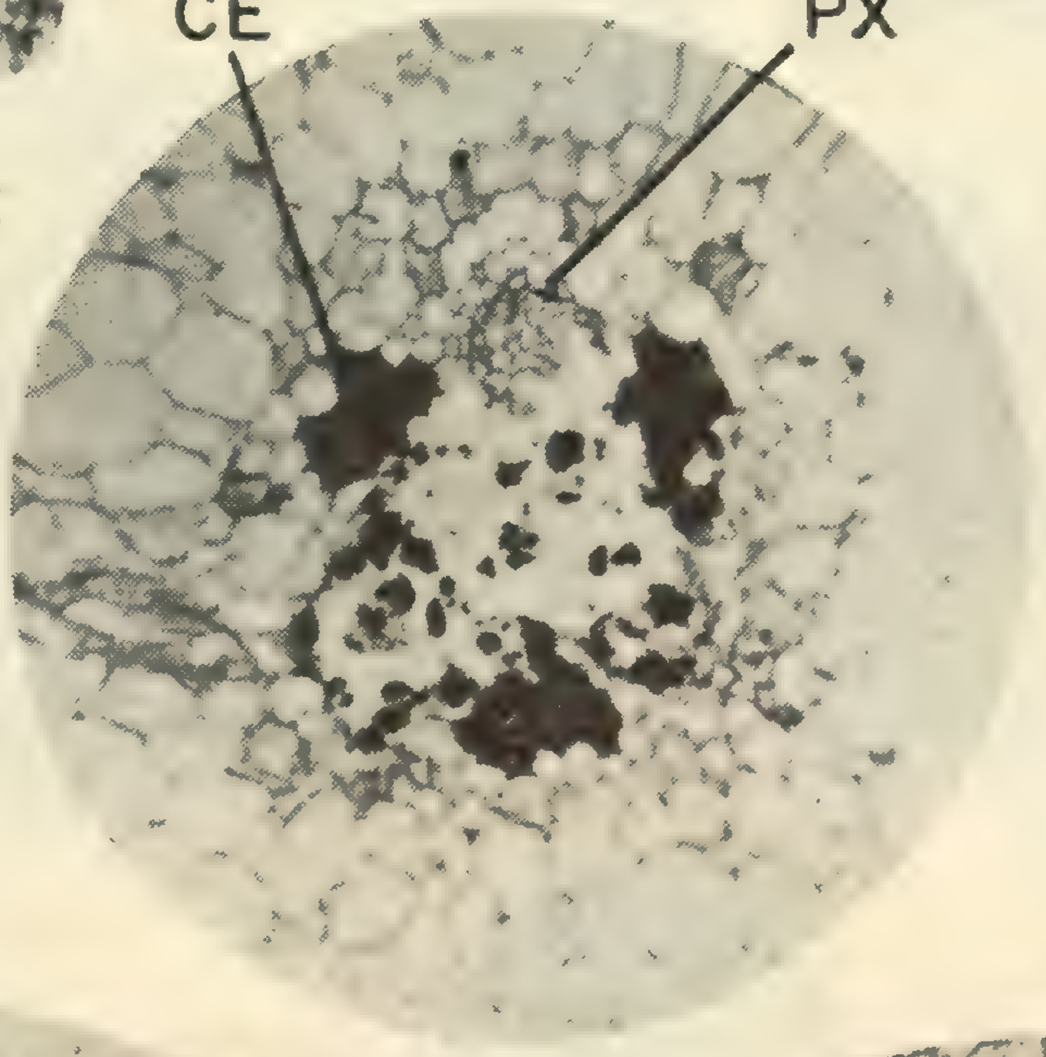

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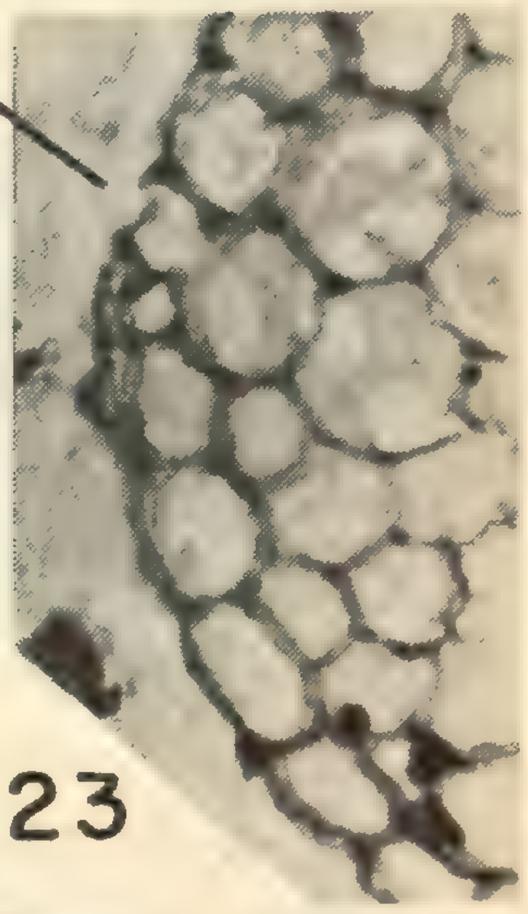

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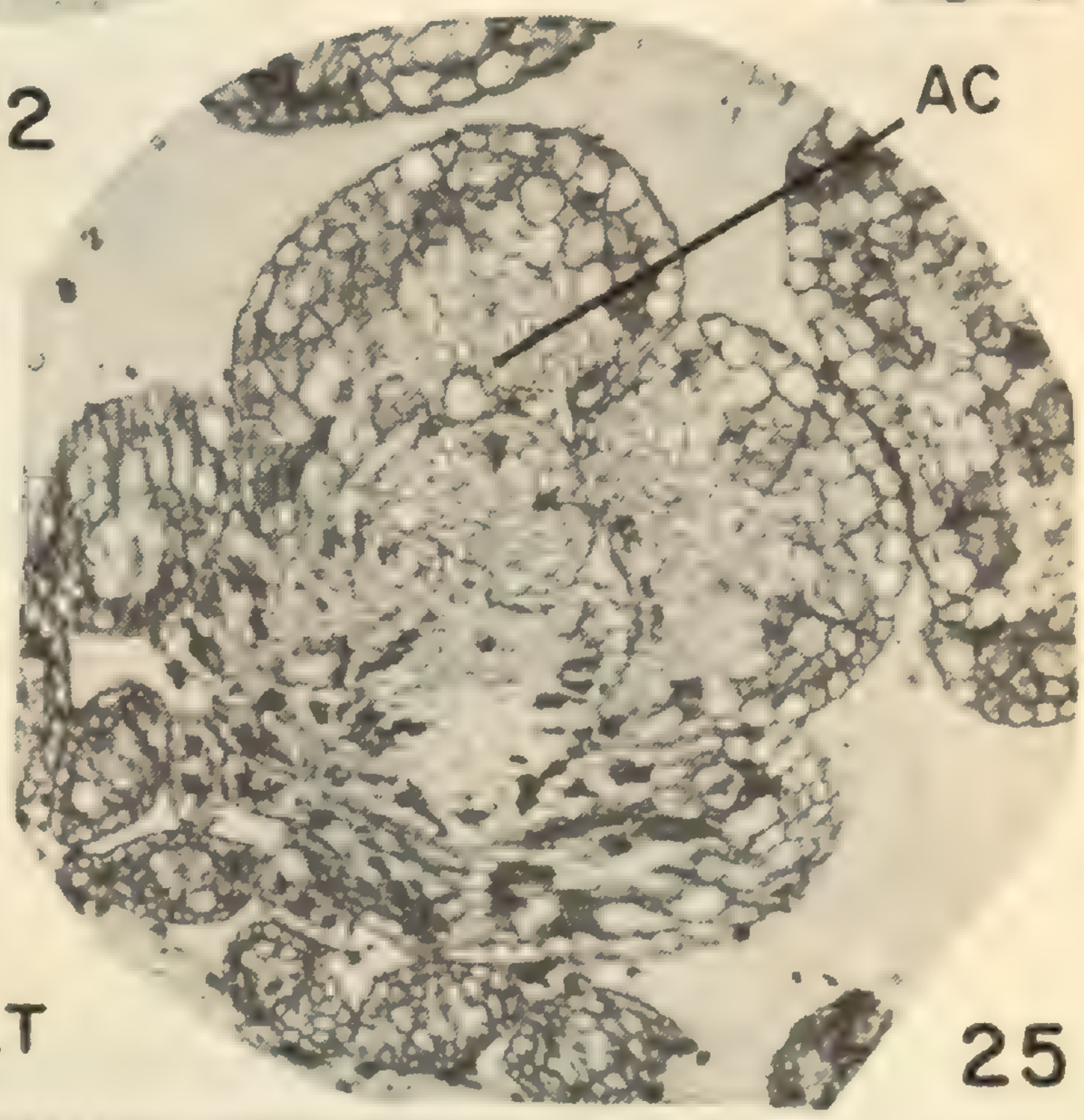

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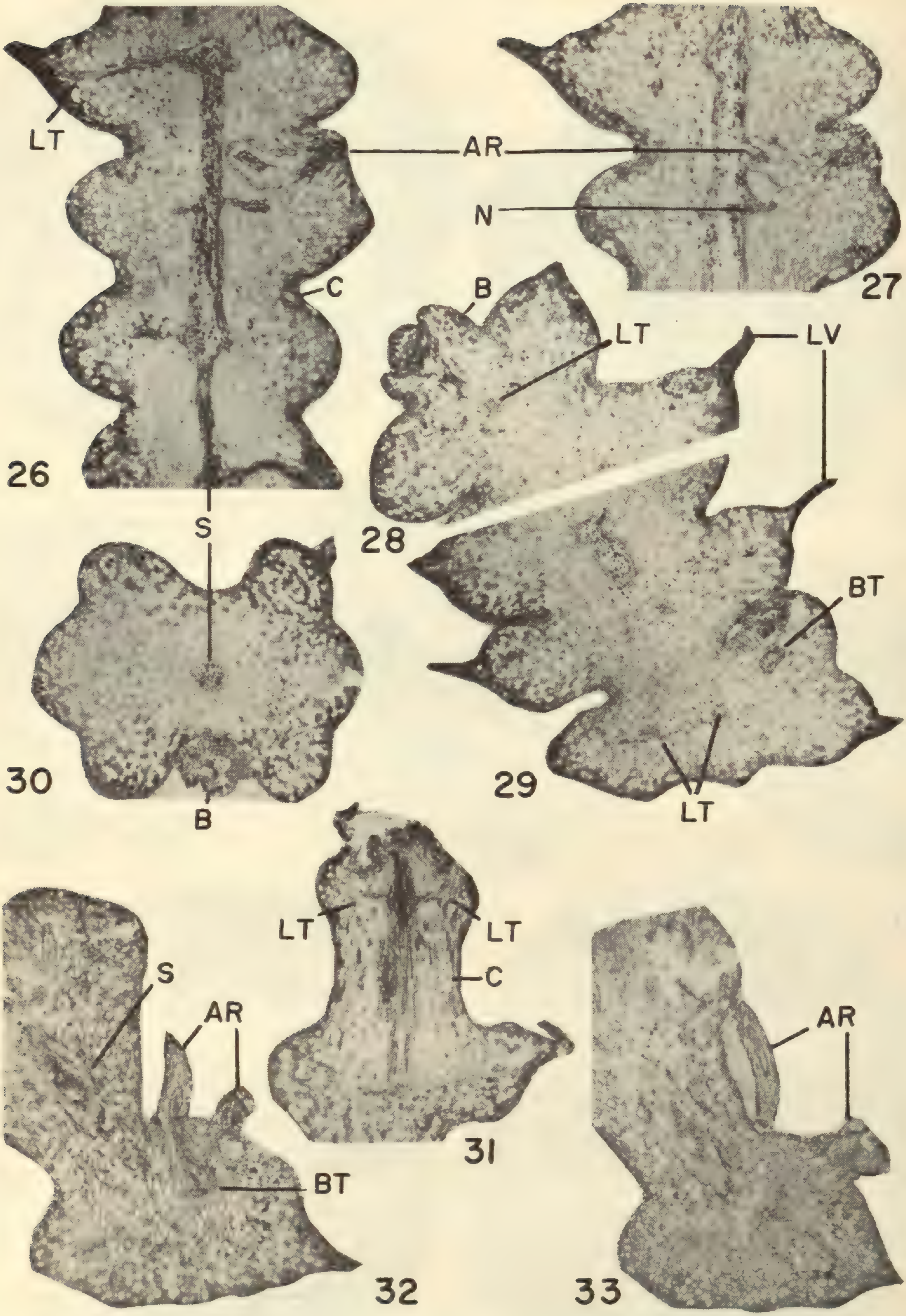
PHILLIPS—SPHENOPHYLLUM CONSTRICTUM



PHILLIPS—SPHENOPHYLLUM CONSTRICTUM

Explanation of Plate

PLATE 4

Sphenophyllum constrictum sp. nov.

Figure 26. Longitudinal section of stem showing four nodes with one leaf, upper left. LT, leaf trace; AR, adventitious root; C, small chamber separated by one cell from the epidermis; S, unpreserved stelar area, from Kansas.
Slide 2761 × 10 III

Figure 27. Longitudinal section in serial sequence of stem in fig. 26. AR, adventitious root shown in cauline vascular connection internodally above N, node.
Slide 2764 × 10 III

Figure 28. Oblique longitudinal section of young stem passing longitudinally through B, nascent branch directly above LT, leaf trace. LV, leaf. See fig. 24 for enlargement.
Slide 2659 × 10 I

Figure 29. Oblique longitudinal section of young stem passing obliquely through a young branch. LV, leaf; LT, leaf traces; BT, branch trace.
Slide 2675 × 10 I

Figure 30. Oblique transverse section of young stem. S, stelar area; B, bud.
Slide 2688 × 10 I

Figure 31. Longitudinal section of a young branch with apex. LT, leaf traces; C, elongated cortical tissue.
Slide 2855 × 10 V

Figure 32. Oblique longitudinal section of mature stem. S, stele of main axis; AR, two adventitious roots emanating from BT, branch trace.
Slide 2910 × 10 VIII

Figure 33. Serial peel sequence of fig. 32. Two adventitious roots departing from branch, one on right bifurcating, note leaf trace below.
Slide 2909 × 10 VIII

SUSTAINED TREATMENT WITH GIBBERELLIC ACID OF FIVE DIFFERENT KINDS OF MAIZE*

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Profound morphological and physiological responses can be induced in many plants by application of the fungal metabolite gibberellic acid (hereinafter called GA). The history of GA has been summarized by Stowe and Yamaki (1957). They indicated that early Japanese work involving *Zea Mays* was performed with extracts prepared directly from cultures of the fungus *Gibberella fujikuroi* (Saw.) Wr. which had been isolated from rice plants, and was mainly concerned with effects on stem elongation. The fungus itself they cited as being reported on maize; indeed, the first valid description of its imperfect stage, designated *Fusarium moniliforme* Sheld., was made from infected maize. Morphological effects noted in these early reports were not consistent; artificial infections of maize with the fungus apparently caused overgrowth, while natural infections did not.

Applications of crystalline giberellins to intact maize plants have been reported by few workers. Marth et al. (1956) reported that treated maize responded with an increase in height, but that the effect diminished with time after treatment was stopped. Phinney (1956) was able to obtain a height increase in four genetically recessive dwarfs of maize by continued application to the plants of small amounts of GA every 3–4 days. He stated that a total of 60 micrograms was enough to cause a genetic dwarf *(dwarf-1)* plant to attain the same height as normal controls, and that this same dosage had no effect on genetically normal plants. Normal plants would, however, respond to increased doses by increase in height. Response of dwarf maize plants has been interpreted as an instance in higher plants where a gene defect in a stepwise series of biochemical reactions is overcome by the addition of GA (Brian and Grove, 1957).

Langridge (1955) interpreted in the same manner his finding that a simple mutant of *Arabidopsis thaliana* responded to thiamine to give normal growth. The response of dwarf *Lolium* to GA is another instance of this same phenomenon (Cooper, 1958). This explanation has not been deemed adequate, however, to explain the overcoming of dwarfness in peas, where several genes are involved (Brian, 1957, 1959). Moreover, other work with maize, reported elsewhere (Nickerson, 1959, in press) shows that GA effectively overcomes the characteristics of two dominant maize mutants, Teopod *(Te)* and Corn-grass *(Cg)*, rendering these genetic forms essentially normal in appearance.

Nelson and Rossman (1958) and Wittwer and Bukovac (1958) reported upon a hitherto unknown effect of GA. Male sterility was caused by treatment of normal sweet corn and inbred dent lines (R53 and OH51) when tassels were, according to the first authors, 1″ long and according to the second authors, 4–6 cm. long.

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Results reported below independently verify this effect of treatment with GA.

No study of the effects of various concentrations of GA on the external morphology of different kinds of corn grown under the same conditions exists. During the winter of 1956-57, a small pilot project was carried out on 64 plants of the sweet corn hybrid *Spancross* in the greenhouse of the Department of Botany, Cornell University, Ithaca, N. Y. Results obtained from treated plants were quite startling; tassel branches were not formed, ears were suppressed, tillers did not develop, and pistillate florets which formed viable caryopses developed in male-sterile tassels of plants which, compared to controls, averaged 50% taller. However, because of results reported by Schaffner (1927, 1930) on sex reversal in maize tassels under short days, of pictures of Singleton's (1946) normal greenhouse-grown plants which clearly show silks in the tassel, and of results noted by Went (1957), where the same induction of pistillate growth was obtained in tassels of plants grown at relatively low temperatures, a more comprehensive experiment under field conditions seemed warranted.

Materials and Methods:

Five kinds of maize were employed in this study. Two were representatives of the well-defined races (for discussion of the race concept in maize, see Anderson and Cutler, 1942) Northern Flint and Zapalote Chico. Parker's Flint was one of the Northern Flints studied by Brown and Anderson (1947); it was chosen because it was well adapted to the area in which the plants were to be grown. Zapalote Chico, studied by Wellhausen et al. (1951, 1952) was chosen because it was an extremely vigorous day-length-independent Mexican dent corn of different morphological type than most U. S. maize. Two other kinds were the inbreds Wisconsin CC5 and L317, chosen because of their widespread use by E. G. Anderson and others as standards in genetic studies (Nickerson and Dale, 1955). The fifth type was Spancross, the hybrid sweet corn mentioned above. Its pedigree and field behavior are well known (Enzie, 1943; Singleton, 1948).

Five plots of each kind of maize[1] were planted in a randomized field of twenty-five plots. Plots were four feet apart each way; the ten plants in each of the five rows of each plot were 20 inches apart each way. All plants in any one row of each plot were subjected to the same treatment. The distribution of treatments within each plot was also randomized. Five treatments were employed:

1 — distilled water (controls)
2 — distilled water with 5 ppm GA
3 — distilled water with 25 ppm GA
4 — distilled water with 125 ppm GA
5 — distilled water with 625 ppm GA

[1] Grateful acknowledgement is made to the following individuals for their cooperation in supplying seed: Dr. Wm. L. Brown, Pioneer Hi-Bred Corn Co., Johnston, Iowa, for Parker's Flint and CC5; Dr. Willis Skrdla, Plant Introduction Station, Iowa State Colleges, Ames, Iowa, for Zapalote Chico (P. I. 217413); Professor A. A. Johnson, Dept. of Plant Breeding, Cornell University, Ithaca, N. Y., for L317. Spancross seed was purchased from GLF Seed Store, Ithaca, New York.

Every three days one ml. of the appropriate solution, which contained the above-listed concentration as micrograms of GA, was applied from a pipette into the apical leaf cavity of each of the 1250 plants used. The solutions were freshly made each week, and kept in darkness at 19° C.[2] To eliminate any possible effect of interaction between insecticides, fungicides and GA, no spraying was done either for fungi, of which none was noted, or for insects, of which both corn earworm and corn borer were noted. Fertilizer (Agrico 5-10-10) was applied at the rate of 600 lbs. per acre three and six weeks after germination. Planting date was June 8, 1958; treatments began June 24 and continued until tassel emergence (Table 1).

TABLE 1

TOTAL AMOUNT OF GA RECEIVED BY EACH PLANT IN MICROGRAMS

	No. of Treatments	Amount of GA per treatment				
		0	5	25	125	625
Spancross	12	0	60	300	1500	7500
Parker's Flint	14	0	70	350	1750	8750
Zapalote Chico	17	0	85	425	2125	10625
CC5	19	0	95	475	2375	11875
L317	19	0	95	475	2375	11875

Results:

No differences in response were noted among each of the five plots of any one kind of maize. Agreement was very close as to height of plants, internode lengths, numbers of tassel branches, ears and tillers, rapidity of effects of GA, and effects noted at each concentration employed. The results are therefore attributed directly to the treatment given rather than to any environmental variation. In determining average effects (Tables 2–6), all plants of one kind which received a particular treatment were included, regardless of location in the field. Wind damage was due to brittleness of treated plants; to assure some survivors, as many as possible, beginning with the plants receiving the highest concentrations and working down, were staked and tied. These lines are noticeable on some of the figures (Plates 6–10).

[2] The GA employed was kindly supplied by Dr. Curt Leben, Argicultural Research Division, Eli Lilly and Co., Greenfield, Indiana.

Hybrid Spancross. (Tables 1, 2; Fig. 1, Plate 6). Treatments with 25 ppm were most effective in promoting stem elongation; higher concentrations induced poor overall vegetative growth and reduced ear and tiller formation. Adventitious brace or prop roots were formed only on the two lower nodes of controls, but they appeared at all nodes below the ear on plants given GA. Tassel branch reduction was linearly related to increased concentrations. Male sterility and development of pistillate florets also increased with increased concentrations. The terminal inflorescences produced, having few or no primary branches, pistillate spikelets below and staminate spikelets above, greatly resembled those of *Tripsacum-Zea* hybrids (Mangelsdorf and Reeves, 1939; see their figure 31.). Rachises in these treated tassels may be disarticulated into segments in the same manner as those of *Tripsacum* inflorescences. Spikelets, however, are in pairs, and may be either both pistillate (as in several tassel-seed mutants) or the member of a pair may be pistillate and the pedicellate staminate (as in Tassel-seed 3; Nickerson & Dale, 1955). Cupules (Nickerson, 1954; Galinat, 1956) were developed in both instances. Worm damage was general in ears and some tassels; damaged plants were excluded from Table 2 below. Ears of controls and the first two concentrations were apparently identical; those from 125 ppm plants were smaller than control ears. Ears from 625 ppm plants were small, with aborted apices, and resembling strawberry pop ears in shape.

Parker's Flint. (Tables 1, 3; Fig. 1; Plates 5, 7). The 25 ppm treatment was most effective in promoting stem elongation and development of basal internodes. This effect extended to tassel branches which were ¼ to ½ again as long as those of controls. Brace roots appeared as far as 30 cm. above ground on the lower 3–4 nodes of treated plants; controls showed brace root development on only the two lowest nodes. Average tiller number, ear number and tassel branch number decreased with increasing treatment. Male sterility was more prominent than development of female spikelets, but the latter did occur. The two higher treatments tended to produce thin spindly plants with long, narrow, often rolled leaves; many plants were rejected because of failure to extrude tassels. Dissections of these plants revealed only rudiments of tassels present. The 125 ppm treatment seemed to be more detrimental to growth than the 625 ppm treatment. Worm damage, especially to ears, was most extensive in this group. Ears of controls and of the first two treatments were alike in appearance. Ears of 125 ppm plants were about half the size of controls. Ears of 625 ppm plants did not mature. Tillers (axillary shoots) were apparently induced to develop after unintentional decapitation by wind breakage occurred on plants receiving higher treatments. This effect of axillary suppression in intact plants and stimulation in decapitated ones was noted in peas by Brian et al. (1955) and Brian (1957). This same phenomenon occurred also in three other types listed below, all normally tillerless.

Zapalote Chico. (Tables 1, 4; Fig. 1; Plate 8). The 125 ppm treatment was most effective in promoting stem elongation; an average height nearly double that of controls was noted. The greatest number of nodes was likewise formed under this

treatment. All extra nodes were below the point of attachment of the ear. Brace roots appeared in controls and on 5 ppm plants on the two lowermost nodes. All other treated plants developed brace roots on the lower 4–6 nodes, at distances as high as 70–100 cm. above the ground. Width of leaves was reduced to 3–4 cm., while controls had leaves 6–9 cm. wide. Average number of ears and tassel branch number decreased, while male sterility and pistillate spikelet development increased with increasing treatment strength. Damage from wind was high in the tall plants, where internodal diameters averages less than 1 cm. compared to 2.5–3.5 cm. of controls. This maize was the most vigorous of the five types here considered; plants formed excellent ears and tassels completely free from worm damage. Most exclusions in this group resulted from non-exsertion of tassels and failure of tassels to develop anything more than primordia of branches and florets. Most of these latter ones were pistillate, but had neither cupules nor functional parts. Ears of controls and of the first two treatments were alike in appearance. Ears of 125 ppm plants were reduced in size and in fertility; few caryopses formed. Ears of 625 ppm plants did not mature.

Inbred CC5. (Tables 1, 5; Fig. 1; Plate 9). No significant increase in height with increasing dosage was noted. Plants normally do not form tillers, and did not with treatment. Brace roots were formed at the lowest two nodes on controls, at the lowest 3–4 nodes with 5 ppm treatment and at the lowest 4–7 nodes with 25 ppm treatment. Ear number and tassel branch number decreased with increasing concentration; male sterility was significant at the 25 ppm treatment and pistillate development was marked in the few plants surviving the higher treatments. At a treatment of 125 ppm, plants were twisted and swollen at the nodes; nearly 70% of them were killed by the tenth to twelfth treatment. Of those surviving, most failed to exsert a tassel. The same effect, only more pronounced (90% kill), occurred with 625 ppm plants. A few plants in both 25 ppm and 125 ppm groups gave no visible response to the treatment. Aside from modified tassels, these survivors resembled the controls. Rejected plants generally did not exsert tassels; when these were dissected and examined, they were found to be composed of pistillate rudiments and were apparently male sterile. Ears were alike in appearance in controls and with 5 ppm and 25 ppm treatments. No ears were matured at higher concentrations.

Inbred L317. (Tables 1, 6; Fig. 1; Plates 5, 10). Response in height was greatest at the lowest treatment of 5 ppm. Vegetative growth was affected above that point, with higher treatments increasingly effective in producing twisted and contorted plants which generally died. Plants did not form tillers on either controls or test plants. Brace roots were formed at the lowest 1 or 2 nodes of controls and at the lowest three nodes in both 5 ppm and 25 ppm treatments. Male sterility and pistillate development increased with higher concentrations. The same situation mentioned above occurred here also; two plants out of 50 given the 625 ppm treatment did not die but became about 20% taller than the controls. Rejected plants generally did not exsert tassels. Upon dissection, these tassels were found

to be rudimentary, mostly pistillate, and apparently male sterile. Ears were alike in controls and 5 ppm plants, but did not mature at higher concentrations.

Discussion and Conclusions:

GA causes marked response in stem elongation, but its effect is dependent both upon the race of maize studied and the concentration of GA employed. Total height is in itself a nebulous measure of elongation effects in GA-treated plants. Internode diagrams (Anderson and Schregardus, 1944) provide a means for more direct comprehension of just where growth is increased. Brian et al. (1958) maintained that GA did not delay maturation of pea internodes but rather matured them early. They reported that the rate of extension was speeded up. The same may be true in maize, because internodes did not elongate indefinitely. Plate 1 shows that the elongation was extremely rapid. Internode diagrams were constructed whenever possible for five plants of each of the treated groups of each maize type. One representative diagram of each group is shown in Fig. 1. These were constructed from the tassel down, hence the internodes were drawn in the inverse order of their appearance, and tassels are at the same relative position on each graph.

The top row represents controls in each maize type. Spancross and Parker's Flint essentially exhibit increasing internode lengths from base to top of plant. Zapalote Chico reaches a maximum below the ear then shows a succession of shorter internodes up to the peduncle, the internode just below the tassel. CC5 has a slightly modified Parker's Flint curve; L317 has gradually elongating internodes up to the ear, then shortening internodes to the tassel. A vertical comparison of diagrams in each column will show what concentrations affected which internodes within one kind of maize; horizontal comparisons will show how the various maizes responded to the same concentration of GA.

In Spancross, 5 ppm gave an increase in all internodes except the lowest and highest. With 25 ppm, greater elongation occurred in the internodes below the ear compared with controls. This trend was accentuated by the 125 ppm and 625 ppm concentrations. With the latter concentration, internode elongation above the ear fell off drastically, with a slight recovery noted in the peduncle.

In Parker's Flint, the 5 ppm and 25 ppm concentrations caused general increase in all internode lengths. Extra internodes were apparently formed under all treatments, always below ears. Brian (1957) reported that GA had no effect on internode number in peas. In maize, these extra internodes were found not to be expansions of normally short internodes at the base of the plant, but new ones added in between the established base of the plant and the node bearing the ear, apparently before differentiation by the meristem of tassel and ear primordia. 125 ppm on Parker's Flint caused a rapid decline in vegetative growth after initial rapid and extreme elongation. With 625 ppm, the plants exhibited three peaks of elongation; one early, one associated with the ear node and one associated with the peduncle.

In Zapalote Chico, nodes below the ear were stimulated with 5 ppm. With 25 ppm, this stimulation was more marked; an early peak was followed by decreases in length up to the ear node, after which the same pattern already noted took place. The 125 ppm treatment produced marked early elongation, followed by a gradual dropping in length of most subsequent internodes and a slight upturn associated with the peduncle. 625 ppm produced the greatest initial elongation, but after a peak the drop in rate was rapid, again with a slight upturn associated with the peduncle.

In CC5, 5 ppm and 25 ppm caused marked elongation of early internodes, but this effect did not persist. Both above and below the ear node, variations seen in the successive lengths of control internodes were accentuated. The 125 ppm concentration, which only 4 plants survived, showed extensive early elongation followed by a steady decline.

In L317, lower internodes were stimulated only slightly by 5 ppm, while internodes *above* the ear increased in length along the same pattern as controls. At 25 ppm, the four internodes *below* the ear showed most elongation; the lowest internodes were apparently inhibited by GA.

The greatest elongations were not obtained under poor growing conditions, which Applegate (1958) and Wittwer and Bukovac (1958) noted were apparently best for maximum expression of the potentialities of GA. The plants in this experiment had soil moisture and temperatures optimum for maize growth when the effects noted above were being manifested. In summary, the same internodes of one kind of maize reacted differently but characteristically to each of the concentrations of GA employed. When homologous internodes of two kinds of maize are compared, their reaction to a particular concentration of GA was also different but characteristic for each maize.

The higher concentrations of GA tended to weaken plants, reduce growth in length, cause swelling at nodes, twisting of culms, poor leaf blade development (rolled, narrow and with various degrees of chlorosis), and brittle leaf sheaths which often separated from the culms. Inbreds responded most drastically to these concentrations and were either killed or greatly reduced in size; the hybrid was least affected. Survival of a few inbreds among populations which were essentially wiped out by certain treatments probably indicates a history of non-selection for physiological variability within morphologically constant plants.

The inflorescences developed by treated Spancross plants may be of some importance to students of maize history, because large-glumed strawberry-like ears (with, in this case, full-sized kernels) and unbranched or slightly branched terminal inflorescences with pistillate parts below and staminate parts above are close to what Mangelsdorf (1954) has postulated as a forerunner of today's corn. The articulation of the rachis of this artificially-produced inflorescence into joints containing one pair of spikelets in the same manner as wild grasses like *Tripsacum* is of further significance. One interpretation of these observations is that GA allows genes suppressed by modifying factors to become expressed. Cases of re-

version from adult to juvenile foliage by treatment with GA in *Poa pratensis* (Leben and Barton, 1957) and in *Hedera* (Robbins, 1957) and of a prolonging of the juvenile leaf form in *Ipomoea* (Njoku, 1958) and peas (Barber et al., 1958) are possibly subject to a like interpretation. The concentration of GA employed may be of significance, for relatively small amounts applied to seedlings of *Eucalyptus* were reported to bring about early development of adult foliage (Scurfield and Moore, 1958). Evolution may involve not only specific mutation of genes for particular characters from one state to another, but also a superimposing of modifications on their expression which leaves the original genes still present and basically unchanged.

In general, GA reduces branching relationships in intact maize plants, restricting formation of ears, tillers and tassel branches in inverse proportion to the concentration employed. As mentioned above, tiller formation was enhanced on decapitated plants, an observation also in line with the findings of others (Brian, 1957). Production of pistillate or mixed staminate-pistillate spikelet pairs in the tassel essentially duplicates some of the effects attributed to a recessive gene (Tassel-seed 1 or ts_1) and a dominant gene (Tassel-seed 3 or Ts_3). Significantly, ear production in both these genetic forms and the GA-produced ones is reduced (Nickerson and Dale, 1955). The development of pistillate spikelets is not too surprising, for Weatherwax (1916) pointed out the fact that all florets of maize are potentially perfect.

Brace root formation was enhanced by several different concentrations of GA applied at points well away from their areas of emergence on the plants. Their stimulation by GA agrees with the report by Whaley and Kephart (1957) who found that in culture, maize root stimulation was a function of the GA concentration. Robbins (1958) also reported stimulation of maize root growth in culture, but at relatively low concentrations of GA. Stowe and Yamaki (1957) presented conflicting evidence. Brian (1959) stated that root growth of intact plants is not known to be stimulated by GA. On the basis of the observations noted above, it seems reasonable to conclude that adventitious root formation can be stimulated by GA in grasses, with effects depending upon concentrations and the plant involved.

The induction of male sterility by GA may well have a use in hybrid corn breeding, as Nelson and Rossman (1958) pointed out. In the plants described earlier, male sterility was brought about by failure of stamens to form. Glumes, lemmas and paleas were generally formed; tassels resembled those of the recessive mutant tassel-seed 8 (ts_8) (Nickerson and Dale, 1955). Tips of branches and of central spikes on many treated plants were often sterile, even when pollen-shedding stamens occurred in the proximal parts of tassels. The effect was more pronounced with increased concentrations of GA.

These results indicate that GA is a powerful aid to morphological study in that it can cause expression of normally undeveloped plant parts and modification of basic plant structures. It further shows that consistent treatments produce consistent results, and suggests that these modified forms may be relied upon to contribute valid data to problems of plant structure.

Summary:

One hybrid, two inbreds and representatives of two exotic kinds of maize were subjected to four different concentrations of Gibberellic Acid throughout the growing season. Internode diagrams of controls and treated plants demonstrated that the increase in height which was generally observed took place neither in the same nodes for different kinds of maize nor to the same extent for particular nodes of one kind of maize subjected to different GA concentrations. A general reduction of branching occurred in all cases. High concentrations of GA inhibited vegetative growth, eventually killing some plants. The hybrid was least changed; inbreds were profoundly modified. Male sterility and pistillate florets in tassels which resembled certain dominant and recessive mutants were obtained in all groups. One group produced terminal inflorescences which in their organization and manner of articulation strongly resembled terminal inflorescences of *Tripsacum*. Brace root formation was stimulated with increased concentrations of GA.

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TABLE 2 — HYBRID SPANCROSS

	Treatment in ppm of GA	0	5	25	125	625
	Height (Av. of 5 plants to nearest cm.)	89	103	136	106	84
	Number of Nodes (Av. of 5 plants)	8	8	8.6	8.8	8.4
Averages of all available plants (maximum number, 50 per column)	Number of Tillers	1.8	0.8	0.2	0.0	0.0
	Number of Ears	1.8	2.0	1.6	1.1	0.7
	Number of Primary Tassel Branches	3.2	2.0	2.0	1.7	1.5
	Percent of Tassels wholly Male Sterile	0	0	8.8	67	95
	Percent of Tassels with Functional Pistillate Florets	0	8	20	72	95
Plants discarded per group of 50	Number of Plants Dying From Treatment	0	0	1	0	5
	Number of Plants Broken by Wind	0	3	4	1	7
	Number of Plants Excluded	5	11	11	10	12

TABLE 3 — PARKER'S FLINT

	Treatment in ppm of GA	0	5	25	125	625
	Height (Av. of 5 plants to nearest cm.)	162	136	180	113	174
	Number of Nodes (Av. of 5 plants)	8	8.8	10.2	8.8	9.6
Averages of all available plants (maximum number, 50 per column)	Number of Tillers	2.9	2.2	0.7	0.2	0
	Number of Ears	2.1	1.8	1.7	0.6	0.4
	Number of Primary Tassel Branches	9.8	9	8	5	5
	Percent of Tassels wholly Male Sterile	0	0	3	79	96
	Percent of Tassels with Functional Pistillate Florets	0	0	0	16	46
Plants discarded per group of 50	Number of Plants Dying From Treatment	0	0	1	3	4
	Number of Plants Broken by Wind	0	2	6	11	9
	Number of Plants Excluded	0	2	8	17	13

TABLE 4 — ZAPALOTE CHICO

	Treatment in ppm of GA	0	5	25	125	625
	Height (Av. of 5 plants to nearest cm.)	169	186	198	248	202
	Number of Nodes (Av. of 5 plants)	11.2	12.2	13.4	14.2	13.6
Averages of all available plants (maximum number, 50 per column)	Number of Tillers	0	0	0	0	0
	Number of Ears	1.4	1.4	0.8	0.8	0.1
	Number of Primary Tassel Branches	20.6	17.8	14.7	15.9	8.8
	Percent of Tassels wholly Male Sterile	0	0	0	38	79
	Percent of Tassels with Functional Pistillate Florets	0	0	0	3	63
Plants discarded per group of 50	Number of Plants Dying From Treatment	0	0	0	1	8
	Number of Plants Broken by Wind	0	0	13	11	7
	Number of Plants Excluded	0	0	4	9	16

TABLE 5 — INBRED CC5

	Treatment in ppm of GA	0	5	25	125	625
	Height (Av. of 5 plants to nearest cm.)	150	141	162	Insuff. No. of plants	Insuff. No. of plants
	Number of Nodes (Av. of 5 plants)	12.4	12.6	12.6	Insuff. No. of plants	Insuff. No. of plants
Averages of all available plants (maximum number, 50 per column)	Number of Tillers	0	0	0	0	0
	Number of Ears	1.8	1.5	0.7	0	0
	Number of Primary Tassel Branches	6.7	4.6	5.0	5.2	0
	Percent of Tassels wholly Male Sterile	0	0	80	100	0
	Percent of Tassels with Functional Pistillate Florets	0	0	7	100	0
Plants discarded per group of 50	Number of Plants Dying From Treatment	0	3	8	34	45
	Number of Plants Broken by Wind	1	5	12	2	0
	Number of Plants Excluded	1	3	15	10	5

TABLE 6 — INBRED L317

	Treatment in ppm of GA	0	5	25	125	625
	Height (Av. of 5 plants to nearest cm.)	154	161	144	Insuff. No. of plants	Insuff. No. of plants
	Number of Nodes (Av. of 5 plants)	13.4	13.2	13.0	Insuff. No. of plants	Insuff. No. of plants
Averages of all available plants (maximum number, 50 per column)	Number of Tillers	0	0	0	0	0
	Number of Ears	1.3	1.1	0.5	0	0
	Number of Primary Tassel Branches	9.1	5.9	4.4	0	8.5
	Percent of Tassels wholly Male Sterile	0	0	32	100	100
	Percent of Tassels with Functional Pistillate Florets	0	0	12	100	100
Plants discarded per group of 50	Number of Plants Dying From Treatment	0	5	8	41	39
	Number of Plants Broken by Wind	0	1	4	0	1
	Number of Plants Excluded	7	5	17	7	8

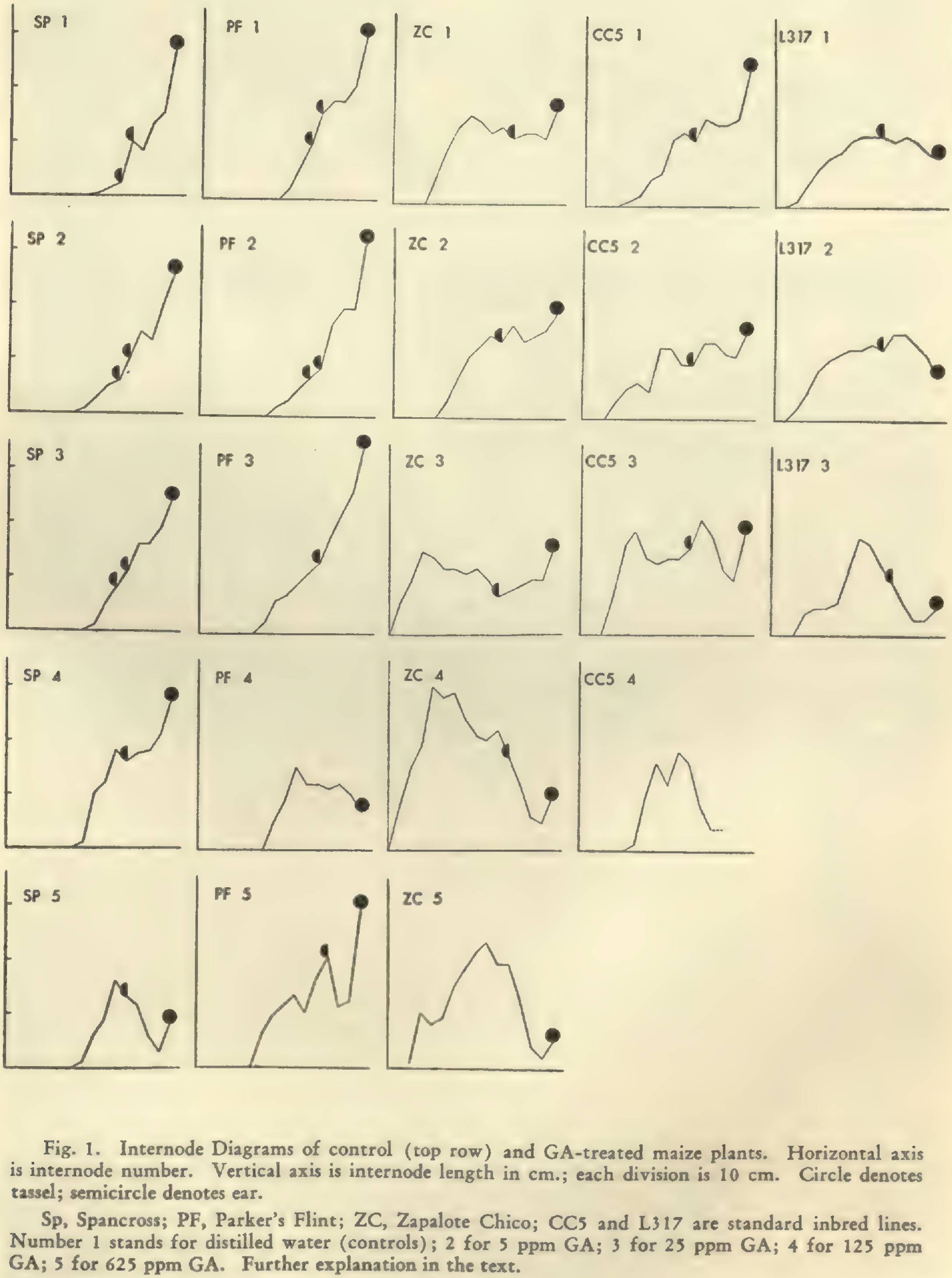

Fig. 1. Internode Diagrams of control (top row) and GA-treated maize plants. Horizontal axis is internode number. Vertical axis is internode length in cm.; each division is 10 cm. Circle denotes tassel; semicircle denotes ear.

Sp, Spancross; PF, Parker's Flint; ZC, Zapalote Chico; CC5 and L317 are standard inbred lines. Number 1 stands for distilled water (controls); 2 for 5 ppm GA; 3 for 25 ppm GA; 4 for 125 ppm GA; 5 for 625 ppm GA. Further explanation in the text.

EXPLANATION OF PLATE

PLATE 5

Plants of Parkers (Northern) Flint and L317 four and one-half weeks after planting and after six consecutive treatments every three days with GA. Lines on background are 10 cm. apart. Note characteristic elongate and angled growth at higher concentrations. Numbers refer to concentration of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Further explanation in the text.

NICKERSON—TREATMENT WITH GIBBERELLIC ACID

NICKERSON—TREATMENT WITH GIBBERELLIC ACID

Explanation of Plate

PLATE 6

Mature plants of Spancross from each GA treatment. Lower right-hand figure shows *Tripsacum*-like tassel common in plants receiving 125 ppm of GA. Numbers refer to concentrations of GA employed as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.

Explanation of Plate

PLATE 7

Mature plants of Parker's (Northern) Flint from each GA treatment. Lower right-hand figure shows male-sterile tassel commonly developed at higher concentrations of GA. Numbers refer to concentrations of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.

NICKERSON—TREATMENT WITH GIBBERELLIC ACID

NICKERSON—TREATMENT WITH GIBBERELLIC ACID

Explanation of Plate

PLATE 8

Mature plants of Zapalote Chico from each GA treatment. Lower right-hand figure shows sterile tassel with rudimentary pistillate parts. Tassel was borne turned 90°, so silks hung down. Numbers refer to concentrations of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.

EXPLANATION OF PLATE

PLATE 9

Mature plants of Inbred CC5 from each GA treatment. None survived treatment 5. Lower right-hand figure shows detail of strongly pistillate tassel developed by a few plants receiving treatment 4. Numbers refer to concentrations of GA employed as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm; Lines on background are 10 cm. apart. Further explanation in the text.

NICKERSON—TREATMENT WITH GIBBERELLIC ACID

NICKERSON—TREATMENT WITH GIBBERELLIC ACID

Explanation of Plate

PLATE 10

Mature plants of Inbred L317 from each GA treatment. Few plants survived treatments 4 and 5. Numbers refer to concentrations of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.

SOME LICHENS OF TROPICAL AFRICA. III. PARMELIACEAE[1]

CARROLL W. DODGE

Since the publication of Part II[2] I have continued to receive specimens for study from the Royal Botanic Gardens at Kew, the East African Herbarium at Nairobi and the Farlow Herbarium of Harvard University, through the kindness of their directors and curators, as well as smaller collections from F. C. Deighton (Sierra Leone) and C. A. Thorold (Nigeria). Among the collections from Kew was one from Ethiopia, gathered by undergraduates of Cambridge University (C.B.E.E.)[3] in the summer of 1957, which was very useful in interpreting several species of which I had seen only very old collections. The director of the Conservatoire Botanique de Genève sent a small collection from the Côte d'Ivoire, collected by Guy Roberty; Professor Edna M. Lind of Makerere College sent a small collection from Kenya and Uganda, collected by A. Burnet; and Mr. Oliver Kerfoot of the East African Agriculture and Forestry Organisation sent his collections from Kenya. I wish to thank all who have supplied specimens for this study. I also wish to express thanks for collections of the late G. M. Allen, of the Museum of Comparative Zoology of Harvard University, given me by the late R. H. Howe, Jr., and Kenya specimens given me many years ago by Mrs. Anita Grosvenor Curtis. The late D. H. Linder gave me a few specimens from his collections while with the Harvard Institute of Tropical Biology and Medicine Expedition 1926–27.

Since many specimens came from the Union of South Africa, Madagascar and Mauritius, I have included in this study all species from regions south of 15° N. latitude. In interpreting handwriting on labels, I have used the gazetteers of the U. S. Board on Geographic Names for British East Africa; Rhodesia and Nyasaland; Angola; and Madagascar, Réunion and the Comoro Islands, as well as the recent Times Atlas for other regions.

Methods

Care has been taken to secure longitudinal sections of the marginal lobes of the thallus, perpendicular to the tip or margin. Since the thallus is usually thinner at the margin than near the center, the thickness of the medulla is recorded as less than that of writers who prepared sections from the central portion of the thallus. If transverse sections are cut, the ends of closely woven longitudinal hyphae will appear pseudoparenchymatous in the medulla and lower cortex. In many cases owing to scanty material, sections of the apothecium have been cut perpendicular to the thecium and where feasible, radial, i.e. perpendicular to the apothecial

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[1] Issued June 17, 1959.

[2] Some lichens of tropical Africa. II. Usnea. Ann. Missouri Bot. Gard. 43:381–396. 1956, 44:1–76. 1957.

[3] The party consisted of the following with their colleges: W. J. Ballantine (Downing), I. M. Evans (Magdalen), J. R. Flenley (Clare), R. G. Hiller (Christ's), C. L. A. Leakey (King's) and J. N. Lythgoe (Trinity). I did not receive locality data on their collections of July 25, 1957, probably along the route from Addis Ababa to the Chokke Mountains.

margin. Colors of the thallus and disc, unless otherwise stated, have been recorded for the dry material. Ridgway's *Color Standards and Color Nomenclature*, 1912, has been used. It is less satisfactory for the Parmeliaceae as many thalli are intermediate between wood brown and olive buff.

Both Phloxine in glycerol and acid fuchsin in Amman's lactophenol have been used as a combined stain and mounting medium. Apparently there is sometimes a reaction between the granules (or very minute crystals) and the lactophenol, especially in the medulla, since the medulla of sections floating in water appears uniformly white or grayish under low magnification, while after staining, brownish granules appear in the medulla. Brownish granules may also result from slow oxidation in the herbarium, often seen in specimens more than a century old

Morphology

Thallus. Branching of lobes is probably dichotomous throughout the family, but is often very irregularly so, i.e. one branch is often somewhat wider. In narrow lobes with short internodes, the branching often appears subpinnate to pinnate. In *Parmelia* subg. *Amphigymnia*, the thallus is more completely monophyllous, margins of short rounded lobes and branching is rarely seen.

Cilia. When present, cilia are characteristic of a species and may be close or distant, usually rarer or nearly absent on sorediate lobes. They are usually best seen on the peripheral lobes, as they are rarely confined to central lobes. They are extremely rare but characteristic when present on the margin and exciple of the apothecium. They are extremely rare and never characteristic on the upper surface of the thallus in our area (except in *Omphalodium*). In a few species of *Parmelia* sect. *Hypotrachyna*, the rhizinae from the underside are quite long and bend outward so that they show beyond the margins of the lobes, and if dense may form a pseudo-hypothallus. At first sight they may be mistaken for short marginal cilia.

Underside. In a few species, the underside is pale and the rhizinae also pale, often translucent. Usually the underside is black or dark fuscous, shading to chestnut or fuscous on the marginal lobes. An abrupt change from black to cream buff on marginal lobes seems due to local environment and seldom affects all lobes of a thallus. This condition is more often seen beneath lobes with sorediate margins. When it occurs quite regularly on one species and not at all on a related species, it is of secondary importance in the separation of species.

Attachment to the substrate. In *Hypogymnia*, rhizinae are completely absent and the thallus is attached to the substrate by stimulation of the cells of the lower cortex to secrete an adhesive gel where in contact with the substrate. If the thallus is removed without long soaking, patches of the lower cortex are torn away, sometimes giving a pseudocyphellate appearance, or if the areas be larger, the appearance of the underside of a *Lobaria*, although the areas are more irregular with more clearly defined borders.

Rhizinae are usually formed by outgrowth of cells of the lower cortex, more rarely from a strand of medullary hyphae corticated by proliferation of cells of the lower cortex. In *Parmelia* subg. *Euparmelia*, the rhizinae are usually quite

dense, slender, simple or more rarely several times dichotomous near the tips, often becoming progressively shorter, passing into papillae toward the margins of the lobes which may be narrowly nude (less than 2 mm. wide) or only slightly verrucose. In a few species of sect. *Xanthoparmelia*, the rhizinae may be very sparse but are always slender and relatively short. In *Parmelia* subg. *Amphigymnia* and in some species of *Pseudevernia*, the rhizinae are stout, either short or long, occurring singly or in small dense clusters ending in a much branched tip forming a disciform holdfast (rarely bulbiform) when the tip makes contact with the substrate. When the tip of the rhizina fails to make contact with the substrate, it is usually much longer with an acute unbranched tip, resembling a cilium.

Gomphus. In *Omphalodium*, a large, central or eccentric gomphus, often up to 10 mm. in diameter, is formed of root-like fibers which penetrate between the crystals of the underlying rock, or between the cells of bark, similar to that found in the Umbilicariaceae. Coarse rhizinae, resembling the cilia, may be present on the underside, but never develop holdfasts. Possibly a gomphus is formed in *Everniopsis* and some species of *Pseudevernia*, but has not been seen as the base is usually torn away in collecting.

Upper cortex. Probably the upper cortex is always fastigiate, usually so highly gelified that only the very slender vertical lumna (protoplasts) may be seen in sections. The terminal cell may be long cylindric, the others short, or the cortex may be pseudoparenchymatous with spherical protoplasts in vertical rows. Very rarely the cortical hyphae are dichotomous above and the protoplasts are more irregularly arranged. In most species the cortex is about 15 μ thick.

Algae. The algae are probably always species of *Trebouxia*, rather than of *Protococcus*, as stated by many former authors. In seven species in which the algae have been isolated in pure culture by Warén, 1920[1] and Jaag 1929, 1933[2] the algae are definitely *Trebouxia*. The algae are often in discrete colonies, but are sometimes so closely packed that the colonial arrangement is not clear. In a few species where the upper cortex is fastigiate and less gelified, cells or columns of algal cells push up between the cortical hyphae for some distance. Very rarely the algal cells are in vertical rows between branches of medullary hyphae, but not truly filamentous.

Medulla. The medulla is white unless otherwise specified in the descriptions. It is usually formed of very thickwalled longitudinal hyphae, sometimes parallel but not conglutinate (except in *Everniopsis*) more often closely interwoven, sometimes throughout, sometimes in only a portion of the medulla. In some species, the hyphae are loosely woven with large air spaces just under the algal layer. In very fragile species and in most species of *Hypogymnia*, the medullar hyphae are loosely woven to arachnoid, and in some species of *Hypogymnia* hyphae may be absent in the center of the thallus, resulting in hollow lobes. In a few species the

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[1] Warén, H. 1920. Reinkulturen von Flechtengonidien. Helsinki. cited by Jaag, 1933.

[2] Jaag, O. 1929. Recherches experimentales sur les gonidies des lichens appartenant aux genres Parmelia et Cladonia. Univ. Genève Thèse **804**:1–128. pl 1–6.

Jaag, O. 1933. Ueber die Verwendbarkeit der Gonidienalgen in der Flechtensystematik. Ber. Schweiz. Bot. Ges. **42**:724–739.

longitudinal hyphae are loosely woven with many oblique hyphae and vertical hyphae connecting the cortices. In general the thickwalled medullary hyphae form the principal mechanical tissue although it is only a sclerotic ribbon in *Everniopsis*.

Lower cortex. The lower cortex is usually of gelified pseudoparenchyma, either fastigiate or from longitudinal hyphae. In the Antarctic *Parmelia* subg. *Physcioideae* (not found in our area) the lower cortex is fibrous rather than pseudoparenchymatous. It is usually dark brown to black throughout, rarely dark only in the outer portion. Sometimes it is reduced to a single layer of cells. In thick sections the cortex appears structureless and carbonaceous. Sections should be longitudinal (i.e. perpendicular to the tip of a lobe) or the lower cortex will appear to be of fastigiate pseudoparenchyma although it may truly be pseudoparenchymatous from longitudinal hyphae.

Apothecium. The disc is usually continuous, but sometimes perforate, especially in *Parmelia* subg. *Amphigymnia*. The amphithecial is similar in structure to that of the thalline upper cortex, but is often much thicker. The algal layer may be better developed than in the thallus, or some algal colonies may die and disintegrate, leaving lacunae which finally may be filled with medullary hyphae, although colonies still persist at the margin. The medulla is similar in structure to that of the thallus but is often more loosely woven with larger air spaces. The thickness of the medulla has not been recorded as it may be very thick near the stipe and very thin, almost disappearing at the margin. The algal layer under the parathecium tends to be thicker and more continuous than that next the amphithecial cortex. In some species this is reversed where the margin remains incurved most of the time.

Parathecium. Usually the parathecium has the same structure as that of the amphithecial cortex and is continuous with it at the margins, but it may be thicker or thinner. Apparently the tissues developing from the ascogonium develop above the cortex. In some species there are suggestions in the arrangement of hypothecial hyphae and paraphyses, either that several or many ascogonia take part in the formation of a compound thecium, or that the periclinal ascogenous hyphae send up short vertical branches which in turn form dense tufts of paraphyses and asci. Not enough very young apothecia have been available to study this question satisfactorily. In one species of sect. *Xanthoparmelia*, one in sect. *Hypotrachyna* and 12 species of the subg. *Amphigymnia*, a true parathecium seems to be absent, being replaced by a pseudo-parathecium formed by partial differentiation of the lower part of the hypothecium into a distinct layer of relatively much thicker-walled pseudoparenchyma from periclinal hyphae with ellipsoid rather than spherical protoplasts, the long axes periclinal. In these species probably the ascogonium develops at the top of the algal layer at the junction with the upper cortex and pushes aside the hyphae of the upper cortex to form the amphithecial cortex. Such very early stages have not been seen in these species. In two species of *Parmelia* subg. *Amphigymnia* the lower part of the parathecium is fastigiate, the upper ends of the hyphae bending outward until the upper portion is periclinal pseudoparenchyma. Rarely the parathecium is reduced to a very thin layer and may be overlooked in thick sections.

Thecium. The thecium is always highly gelified, so that the paraphyses are never free, at least at their tips; their walls are very indistinct. The lumina (protoplasts) are cylindric below, septate, sometimes closely, sometimes sparingly so, about 1 μ in diameter. Dichotomous branching of the paraphyses is usual above the asci, varying from once to about thrice, the branches sometimes moniliform, the tips often narrowly clavate to subspherical, usually ending below the surface of the brownish epithecial gel, which is very thick in young thecia.

Asci. The asci are normally 8-spored, very rarely less by abortion of 1–4 ascospores, i.e. young asci show cleavage of 8 ascospore initials, although mature asci show only 4–5 ascospores with remnants of the others. The asci are fundamentally all clavate, but just before spore discharge, they may appear cylindric (ascospores monostichous) or ellipsoid (ascospores distichous). The wall is usually thin with a thickened tip when young, but in 13 species the wall is 3 μ or more thick, ascospores usually with thick epispores resembling minute Pertusariaceous asci. The thick wall may thin somewhat as the ascospores mature, but still remaining much thicker than in other families of lichens. The tip may be still thicker, usually with a rounded protoplast (very rarely mamillate), thinning to about the thickness of the rest of the ascus wall as the ascospores mature.

Ascospores. The ascospores are uniformly hyaline and ellipsoidal (spherical or nearly so in *P. sphaerospora* and *P. subplumbeata* in our area). Even in moribund thecia, any ascospores still present remain hyaline. The epispore is relatively thick, resembling those of a *Pertusaria* but presumably uninucleate in a few species. In a very few species it is thin, showing as a single boundary line under 440× magnification. The size is very uniform for a given species except in those species where 3–4 ascospores abort in part of the asci. In these, the dimensions are correspondingly larger since about the same volume of protoplasm is used in forming the surviving ascospores. In *Everniopsis*, the outer boundary of the protoplast in contact with the epispore is rough, as one sees in the Pannariaceae.

Spermogonia. The spermogonia are rather uniform in our area, immersed in the thallus (semiemersed in *Everniopsis*) oblate spheroidal, rarely spherical, the upper portion of the wall about the ostiole dark brown to black, hence usually appearing as black dots on the upper surface of the marginal lobes, very rarely in the center of the thallus or in the apothecial margin or exciple. In four African species they are confined to bullate or subcerebriform prominences resembling the pseudostromata of *Pertusaria*, similar to those species segregated as *Aspidelia* Stirton, based on *A. Beckettii* Stirton from New Zealand, which I know only from the literature. No attempt has been made to section the spermogonia of each species studied, although their structure has been recorded when I have happened to section them. The spermatiophores are septate, the spermatia straight, lateral at the septa of the spermatiophores.

Chemical reactions. The chemical reactions of the medulla have been recorded for each species, using solutions of NaOH and NaOCL (K and C in the text, respectively), also these reagents in combination (KC in the text). Care should be taken to apply the reagent to the whole thickness of the medulla, as in a few species, the medulla shows only a narrow zone of color under the algal layer, while

a related species shows the color throughout the thickness of the medulla. The upper cortex of many species turns yellow with K, and in some of them the dye diffuses and may stain an adjacent exposed portion of the medulla, giving an erroneous appearance of a medullar reaction with K. Apparently some of Nylander's reports of medullar reactions are due to this error.

While I have never depended solely on chemical reactions of the medulla in defining species, I have found such reactions useful with fragmentary or sterile specimens and have often recorded reactions in my key to species, as characters easily observed. Usually a thallus growing in bright sunlight gives a more prompt and definite reaction than one of the same species in dense shade. In a few cases, I have referred specimens to a species when the morphological characters agree with those of the original description, although the chemical reactions observed do not agree. In all such cases, I have mentioned such discrepancies in a note following the formal description.

PARMELIACEAE

Thallus foliose, appressed to erect and subfruticose, dorsiventral, usually corticate on both surfaces, ecorticate below in *Anzia*; algae *Trebouxia*; underside nude or covered with rhizinae which rarely anastomose to form a hypothallus in *Pannoparmelia* and *Anzia*. Apothecia circular, sessile to stipitate; amphithecium well developed; paraphyses simple or dichotomous above the asci, usually conglutinate in the thecial gel; asci normally 8-spored, sometimes less by abortion and 16–32-spored in *Anzia* and *Candelaria*; ascospores hyaline, unicellular, ellipsoid to almost spherical (septate in *Megalopsora* and *Physcidia*). Spermogonia with septate spermatiophores, simple in *Parmeliopsis* and *Anzia*.

Key to Genera of Parmeliaceae in Africa South of 15° N.

1. Thallus attached to the substrate by secretion of adhesive gel from the lower cortex; without rhizinae; lobes narrow, often subterete, appressed to suberect; medulla loosely woven, sometimes hollow in the center.....Hypogymnia
1. Thallus attached to substrate by rhizinae.....2
1. Thallus attachment to substrate unknown, probably a rooting base or gomphus, lobes suberect, recumbent or pendent; not rigid; rhizinae absent or non-functional; cilia when present long, slender.....3
1. Thallus attached by a central or eccentric gomphus, resembling the Umbilicariaceae in habit; thallus very rigid; coarse short cilia and non-functional rhizinae may be present .....Omphalodium
2. Lower cortex pseudoparenchymatous from either longitudinal or fastigiate hyphae....Parmelia
2. Lower cortex of conglutinate longitudinal hyphae, not pseudoparenchymatous....Pseudevernia
3. Medulla of longitudinal hyphae not conglutinate; cilia or non-functional rhizinae often present.....Pseudevernia
3. Medulla of conglutinate longitudinal hyphae; cilia and rhizinae absent; a single species in our area.....Everniopsis

Thallus olive buff above, isabella color below, subnitid, lobes flat, dichotomous, 2–3 mm. wide below, 1 mm. above, 10 cm. long, probably pendent; apothecia 2 mm. in diameter; ascospores 16 × 10 μ, exospore internally rough as in the Pannariaceae.... .....*E. pseudoreticulata* (Duvign.) Dodge

HYPOGYMNIA

Hypogymnia Nyl., Lich. Env. Paris 39. 1896.

Parmelia subg. *Hypogymnia* Nyl., Flora 64:537. 1881.

Type: ***Parmelia physodes*** **(L.) Ach.**

Thallus small, polyphyllous, lobes narrow, more or less linear, convex, lobes or ultimate lobules often nearly terete, inflated, sometimes hollow in the center, frequently with irregular blackened areas above, appressed to the substrate or attached only in the central portions by the secretion of an adhesive substance from the lower cortex, without rhizinae, the outer portions of the lobes often free ascending to erect to recumbent; morphologic upper cortex of conglutinate fastigate hyphae or of fastigate pseudoparenchyma; algal layer under the morphologic upper cortex only, not in a radiate structure of a *Dactylina* and the terete, inflated species of *Ramalina*; medulla K–, C–, KC–, arachnoid or of loosely woven longitudinal hyphae with large air spaces, sometimes hollow in the center, sometimes the hyphae next the morphologic lower cortex larger with brownish thicker walls. Reproduction more often by fragmentation, isidia or soredia; apothecia relatively rare, asci thinwalled at maturity, only the tips thickened when young; ascospores ellipsoidal, small, under 10 μ long; spermogonia not seen in our African material.

The genus is characteristic of alpine and subalpine areas, at very high elevations in the tropics; saxicolous, terricolous or on twigs and small branches rather than on trunks and larger branches in deep shade. The genus is found at low elevations in the Subarctic and in the Subantarctic islands.

Key to Hypogymnia

1. Lobes suberect, 1.5 mm. wide 2
1. Lobes appressed to the substrate 3
   2. Lobes densely isidiose, light buff, underside black, ultimate lobules terete, 0.3–0.4 mm. in diameter; corticole; Uganda ..... *H. cornuta* Dodge
   2. Lobes not isidiose, smooth, pale yellow, underside black; saxicole; South West Africa ..... *H. deserti* (Hue) Dodge
3. Underside chamois in center, black in the outer 2 cm., upper surface cracked into polygonal areoles 1–2 mm. in diameter, irregularly dichotomous, lobes narrowly black margined; apothecia up to 6 mm. in diameter; ascospores 8–9 × 3–4 μ; Southern Rhodesia ..... *H. rhodesiana* Dodge
3. Underside black, rugose, upper surface between citrine drab and buffy brown, lobes 1–2 mm. wide, dichotomous; apothecia up to 7 mm. in diameter, exciple rugose sulcate, subscrobiculate; ascospores 6 × 4μ (immature?); Mauritius ..... *H. inflata* Dodge
3. Underside, black, rugose; sterile 4
   4. Medulla hollow in center, upper layer of longitudinal hyphae, lower arachnoid; lobes irregularly dichotomous, tips digitate; central lobules capitate soraliate; Uganda ..... *H. elgonensis* Dodge
   4. Medulla not hollow, tips of lobes not capitate soraliate 5
5. Lobes dichotomous to subpinnate with digitate tips; medulla of longitudinal, nubilated hyphae in the upper fourth, the rest arachnoid; Tanganyika ..... *H. kiboensis* Dodge
5. Lobes palmately branched; medulla arachnoid, with thickwalled, brown hyphae in the lower half ..... *H. sp.*

Hypogymnia **cornuta** Dodge, sp. nov.

Type: Uganda, Mt. Elgon, 3550 m., on twigs of heath trees in alpine meadow, *A. S. Thomas 607* p. p. min. ex herb. Dept. Agr. Uganda at Kew.

Thallus erectus (aut pendens), 3 cm. altitudine, inferne ca. 1 mm. latitudine, usque ad 2 mm. ad primam dichotomiam, repetite dichotome ramosus, internodis inferis brevibus, superis ad 6 mm. longitudine, lobulis ultimis teretibus, ca. 1 mm. longitudine, 0.3–0.4 mm. diametro, apicibus nigris; superficies superior pallide

alutacea, lobis aliis dense isidiosis, isidiis simplicibus, aliis laevibus aut longitudinaliter rugosis et subscrobiculatis; superficies inferior nigra, opaca, rugosa aut subscrobiculata, sine rhizinis; cortex superior 15 μ crassitudine, hyphis fastigiatis, conglutinatis, cellulis terminalibus clavatis aut subsphaericis; stratum algarum usque ad 30 μ crassitudine, coloniis discretis et cellulis singulis *Trebouxiae*, 7–9 μ diametro; medulla K–, C–, KC–, 130 μ crassitudine, arachnoidea, hyphis pachydermeis, 3 μ diametro, non nubilatis; cortex inferior superiori similis. Apothecia spermogoniaque non visa.

Thallus erect or pendent, 3 cm. tall, about 1 mm. wide below expanding to 2 mm. at the first dichotomy, repeatedly dichotomous, lower internodes short, upper about 6 mm. long, ultimate lobules 1 mm. long, 0.3–0.4 mm. in diameter, black tipped; upper surface light buff, some lobes densely isidiose, isidia simple, other lobes smooth, longitudinally rugose and subscrobiculate; underside black, except on outer lobes, surface dull, rugose to subscrobiculate, without rhizinae; upper cortex 15μ thick, of fastigiate, conglutinate hyphae, outermost cells clavate to subspheric; algal layer up to 30 μ thick, of discrete colonies and single cells of *Trebouxia*, cells 7–9 μ in diameter; medulla K–, C–, KC–, 130 μ thick, very arachnoid, hyphae thickwalled, 3 μ in diameter, not nubilated; lower cortex similar to the upper cortex. Apothecia and spermogonia not seen.

While the habit resembles *Pseudevernia*, the structure is clearly that of *Hypogymnia*.

UGANDA: Mt. Elgon, 3550 m., on twigs of heath trees in alpine meadow, *A. S. Thomas 607* p. p. min. ex herb. Dept. Agr. Uganda at Kew.

HYPOGYMNIA **rhodesiana** Dodge, sp. nov.

Type: Southern Rhodesia, Makoni, Forest Hill Kop, 1610 m., on sloping rock faces; curled up or flat, grey above, brown below; *Frederick Eyles 825* at Kew.

Thallus foliosus, 8 cm. diametro, pallide olivaceo-alutaceus; lobis inferne 5 mm. latitudine, irregulariter dichotomis, lobulis ultimis ca. 1 mm. latitudine, apicibus truncatis aut subretusis, anguste nigromarginatis; superficies superior laevis, subnitida, rimoso-areolata, areolis polygonis, 1–2 mm. diametro, inferior irregulariter rugosa, centro alutacea, marginibus nigris, opaca; cortex superior 40 μ crassitudine, dimidia parte extera hyphis septatis longitudinalibus, 4 μ diametro, granulis brunneo-viridibus nubilatis, parte interiori fastigiata, pseudoparenchymatica, hyalina; stratum algarum ca. 30 μ crassitudine, continuum, cellulis 5–6 μ diametro; medulla K–, C–, KC–, 200 μ crassitudine, dimidia parte superiori arachnoidea, hyphis verticalibus 5–6 μ diametro, parte inferiori densa, hyphis longitudinalibus; cortex inferior 10 μ crassitudine, nigro-brunneus, hyphis longitudinalibus, cellulis rotundatis.

Apothecia ad 6 mm. diametro, sessilia, superficialia aut submarginalia, margine integro inflexo; excipulo laevi aut subruguloso, disco castaneo; cortex amphithecialis 30–35 μ crassitudine, superne cum stratis uno vel duobus hyphis periclinalibus, aliter fastigiatis, hyphis pachydermeis; stratum algarum ca. 20 μ crassitudine, cellulis sparsis, sub parathecio melius evolutum; medulla arachnoidea; parathecium 30 μ crassitudine, fastigiatum, hyphis conglutinatis; hypothecium

15μ crassitudine, hyphis tenuibus, septatis, periclinalibus; thecium 35 μ altitudine; paraphyses tenues, apicibus clavatis, brunneo-viridibus; asci cylindrico-clavati, 22–25 $\times$ 7–8 μ, apicibus incrassatis; ascosporae octonae, distichae, ellipsoideae, 8–9 $\times$ 3–4 μ.

Thallus foliose, 8 cm. in diameter, pale olive buff, lobes 5 mm. wide below, irregularly dichotomous, narrower at each dichotomy, ultimate lobules about 1 mm. wide, tips truncate to slightly retuse, narrowly black margined, surface smooth, subnitid, cracked into the medulla, forming polygonal areas 1–2 mm. in diameter, edges blackened in the older portions of the thallus; another much younger thallus 4 cm. in diameter is similar but smaller in all dimensions with lobes tending to become pinnate, ultimate lobules only 0.8 mm. wide and relatively longer; underside irregularly short rugose, chamois near the center shading to black in the outer 2 cm., surface opaque; upper cortex 40 μ thick, the outer half of septate longitudinal hyphae 4 μ in diameter nubilated with minute greenish brown granules, the lower half fastigiate, hyaline with nearly isodiametric cells; algal layer about 30 μ thick, continuous, of scattered single cells 5–6 μ in diameter and small colonies of *Trebouxia*; medulla K–, C–, KC–, 200 μ thick, the upper half very arachnoid of predominantly vertical hyphae 5–6 μ in diameter, the lower half of longitudinal hyphae increasingly densely interwoven toward the lower cortex; lower cortex 10 μ thick, very dark brown, of longitudinal hyphae, the outermost rather closely septate, the outer cell walls rounded giving the opaque appearance of the surface.

Apothecia up to 6 mm. in diameter, sessile, superficial to submarginal, margin entire, inrolled, exciple smooth to slightly rugose, disc chestnut; amphithecial cortex 30–35 μ thick with 1–2 layers of periclinal hyphae, the rest fastigiate, of very thickwalled hyphae with narrow lumina; algal layer about 20 μ thick, of very scattered algal cells, apparently moribund; medulla arachnoid throughout; algal layer under the parathecium better developed, about 20 μ thick, forming a continuous layer but cells not closely packed; parathecium 30 μ thick, fastigiate, hyphae conglutinate, slenderer with relatively larger lumina than in the cortex; hypothecium 15 μ thick, of slender septate hyphae; thecium 35 μ tall; paraphyses slender, tips clavate, thickwalled, greenish brown, 3-celled; asci cylindric-clavate, 8-spored, 22–25 $\times$ 7–8 μ, tips thickened; ascospores distichous, ellipsoid, 8–9 $\times$ 3–4 μ with a moderately thick epispore.

SOUTHERN RHODESIA: Makoni, Forest Hill Kop, 1610 m., on sloping rock faces, *Frederick Eyles 825* at Kew.

HYPOGYMNIA **inflata** Dodge, sp. nov.

Type: Mauritius, without locality or collector, herb. Hookerianum at Kew, growing with hepatics, substrate unknown.

Thallus suberectus aut decumbens, lobis ca. 20 mm. altitudine, multoties dichotomis, ad internodos ca. 1 mm. latitudine, 1.5–2 mm. infra nodos, basi emoriens, apicibus hemisphaericis, subteretibus, superne siccitate subconvexis, inferne rugosis, rugis anastomosantibus, longitudinalibus, cavis, superne superficie inter citrinorava et alucaceo-brunnea, inferne nigra nitenti, longis cum prominentibus paucis aut papillis inter hepaticis substrato tegens; cortex superior 15 μ crassi-

tudine, pseudoparenchymatice fastigiatus, cellulis 3 μ diametro, luminibus 2 μ diametro, granulis minutis brunneis nubilatus; stratum algarum 35 μ crassitudine, continuum, cellulis 5–6 μ diametro; medulla K–, C–, KC–, superne 40 μ crassitudine, hyphis pachydermeis, ramosis, laxe contextis, 3 μ diametro, granulis hyalinis nubilatis, inferne 35 μ crassitudine, hyphis pachydermeis brunneis longitudinalibus, 3 μ diametro, laxissime contextis, non nubilatis; cortex inferior stratum hypharum 8 μ diametro, septatarum, cellulis isodiametricis.

Apothecia superficialia, ad nodos superiores, margine integro, excipulo longitudinaliter rugoso dein subscrobiculato, disco castaneo; cortex amphithecialis 55 μ crassitudine, pseudoparenchymatice fastigiatus, gelifactus, cellulis 8–9 μ diametro, protoplastis 2.5–3 μ, irregulariter strato amorpho 10–12 μ crassitudine obtectus; stratum algarum coloniis discretis sparsis 15 μ diametro; medulla laxe contexta aut arachnoidea; stratum algarum sub parathecio 30 μ crassitudine, continuum; parathecium ca. 15 μ crassitudine pseudoparenchymatice fastigiatus; hypothecium ca. 15 μ crassitudine, hyphis tenuibus periclinalibus; thecium 40 μ altitudine; paraphyses tenues septatae, semel bisve dichotome super ascos ramosis, ramis moniliformibus, apicibus clavatis; asci clavati, ca. 30 $\times$ 10 μ, apicibus juventute incrassatis; ascosporae octonae, ellipsoideae, 6 $\times$ 4 μ (immaturae ?).

Thallus probably suberect or decumbent, lobes about 20 mm. tall, several times dichotomous, about 1 mm. wide at the internodes, expanding to 1.5–2 mm. just below the next internode, tips hemispheric, dying at the base, probably nearly terete when growing, drying subconvex above, very deeply rugose below, wrinkles anastomosing but predominantly longitudinal, hollow; morphologic upper surface drying between citrine drab and buffy brown, shining, underside black and shining with occasional relatively large and long papilliform prominences, penetrating between the hepatics to make contact with the substrate, on the lower portions of the lobes; morphologic upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells about 3 μ in diameter, lumina 2 μ, in a gel nubilated with minute brownish granules; algal layer 30 μ thick, continuous, cells closely packed, 5–6 μ in diameter; medulla K–, C–, KC–, the layer next the algal layer about 40 μ thick, of very loosely woven thickwalled branched hyphae 3 μ in diameter, nubilated with hyaline granules; the layer next the lower cortex 35 μ thick, very arachnoid, hyphae thickwalled, brownish, 3 μ in diameter, not nubilated, predominantly longitudinal; lower cortex a layer of longitudinal hyphae 8 μ in diameter, deep brown, septate into isodiametric cells.

Apothecia superficial at an upper node (or perhaps a modified lobule); margin entire, exciple longitudinally rugose becoming subscrobiculate, disc chestnut; amphithecial cortex 55 μ thick, of gelified fastigiate pseudoparenchyma, cells 8–9 μ in diameter, protoplasts 2.5–3 μ, irregularly overlaid with an amorphous layer 10–12 μ thick; algal layer of very scattered, discrete colonies of *Trebouxia* about 15 μ in diameter; medulla loosely woven to arachnoid; algal layer under the parathecium 30 μ thick, with an occasional cell deeper in the medulla, continuous; parathecium about 15 μ thick but almost disappearing in places, of fastigiate thickwalled pseudoparenchyma; hypothecium about 15 μ thick, of slender, deeply

staining periclinal hyphae; thecium 40 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches moniliform, tips clavate, reaching the surface of the brownish epithecial gel; asci clavate, about 30 $\times$ 10 μ, tips thickened when young, protoplast long mammillate; ascospores ellipsoidal, 6 $\times$ 4 μ, probably immature.

There are a few pores at the tips of the lobes, but I have been unable to decide if they are normal or teratologic, probably the latter, as one appears as if the tip had been eaten by an insect and the cortex regenerated. Only more and better collections can decide the matter.

MAURITIUS: without locality or collector, growing with hepatics, substrate unknown, herb. Hookerianum at Kew.

HYPOGYMNIA **elgonensis** Dodge, sp. nov.

Type: Uganda, Mt. Elgon, Masaba, 4400 m., on ground with moribund *Cladonia* in alpine meadow, *A. S. Thomas 621* at Kew.

Thallus foliosus, inter alutaceus et olivaceo-alutaceus, lobis ad 20 mm. longitudine, ad basin 3 mm. latitudine, irregulariter dichotomis, apicibus rotundatis, digitatis, lobulis ultimis 1 $\times$ 1 mm., inflatis, excavatis, capitate sorediatis, sorediis granulosis; superficies inferior nigra, rugosa, nitida; cortex superior 20–25 μ crassitudine, gelifactus, pseudoparenchymatice fastigiatus, cellulis 3 μ diametro, luminibus 1 μ, strato amorpho 3 μ crassitudine tectus; stratum algarum 25–30 μ crassitudine, cellulis singulis 7–10 μ diametro et coloniis parvis subdiscretis *Trebouxiae*; medulla K–, C–, KC–, 75–80 μ crassitudine, superne et inferne hyphis longitudinalibus laxe contextis, ad centrum arachnoideis aut nullis; cortex inferior 15 μ crassitudine, niger, pseudoparenchymatice fastigiatus, gelifactus. Apothecia spermogoniaque non visa.

Thallus forming patches 9 cm. in diameter, between buff and olive buff, darkening to bister, pale gray where moribund, peripheral lobes up to 20 mm. long, 3 mm. wide at the base, irregularly dichotomous and subdichotomous, tips rounded, digitate, lobules about 1 mm. long and wide, somewhat inflated, hollow in the center; central lobules becoming capitate sorediate, soredia coarse, granular; underside black shading to Brussels brown on the ultimate lobules, rugose, shining, without rhizinae; upper cortex 20–25 μ thick, of gelified, fastigiate pseudoparenchyma, cells about 3 μ in diameter, lumina 1 μ, heavily nubilated without, less so within, covered by an amorphous layer 3 μ thick; algal layer 25–30 μ thick, of solitary cells and small discrete colonies in a nearly continuous layer, cells 7–10 μ in diameter; medulla K–, C–, KC–, 75–80 μ thick, of loosely woven longitudinal hyphae 3 μ in diameter next the algal layer, very arachnoid toward the hollow center, 30 μ thick next the lower cortex; lower cortex 15 μ thick, of gelified fastigiate pseudoparenchyma. Apothecia and spermogonia not seen.

KENYA: west slope of Mt. Kenya, on trail from West Kenya Forest Station to summit, 3630 m., muscicole, *Edgar A. Mearns 1612* p. p., T. Roosevelt Exp.

UGANDA: Mt. Elgon, Masaba, 4400 m., on ground with moribund *Cladonia* in alpine meadow. *A. S. Thomas 621* at Kew, type.

Hypogymnia kiboensis Dodge, sp. nov.

Type: Tanganyika, Mt. Kilimanjaro, between saddle and Kibo, 4830–5475 m., on volcanic rock, *B. Verdcourt & M. Wilkinson 1228* in E. African Herb.

Thallus foliosus, 3.5 cm. diametro, lobis marginalibus olivaceo-alutaceis, anguste nigromarginatis, laevibus, opacis, inferne nigris, rugosis aut minute scrobiculatis, subimbricatis, centro dichotomis, dein pinnatis lobulis ultimis digitatis, subteretibus, ca. 1 × 0.2 mm.; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 6 μ diametro, dimidia parte extera brunnea; stratum algarum coloniis discretis *Trebouxiae*, 15 μ diametro, cellulis 6–7 μ; medulla K–, C–, KC–, 200 μ crassitudine supra hyphis longitudinalibus nubilatis, infra arachnoidea; cortex inferior 15–20 μ crassitudine, niger, fastigiatus, cellulis 15 × 10 μ.

Thallus foliose, 3.5 cm. in diameter, K–, marginal lobes olive buff shading to citrine drab at the center, narrowly black-margined, smooth, opaque; underside black, rugose to minutely scrobiculate, bleached by C, without rhizinae or cilia; lobes subimbricate, dichotomous near the center then pinnately branched, ultimate lobules digitate and subterete, about 1 × 0.2 mm.; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells about 6 μ in diameter, outer half brownish; algal layer of discrete colonies 15 μ in diameter and single cells of *Trebouxia*, 6–7 μ in diameter; medulla K–, C–, KC–, 200 μ or more thick, the upper 50 μ of moderately interwoven longitudinal hyphae, nubilated with minute hyaline granules, the rest arachnoid or very loosely interwoven with large air spaces; lower cortex 15–20 μ thick, black, fastigiate, cells 15 × 10 μ cutting off thickwalled spherical cells about 4 μ in diameter, accounting for the opaque underside.

The systematic position of this species is not clear. The anatomy of the thallus is somewhat suggestive of *Umbilicaria Haumaniana* Frey, but when the thallus was carefully dissected from the underlying rock, there was no sign of a central holdfast. The color of the upper surface is much lighter than any species of the Umbilicariaceae known to me, being somewhat intermediate between *Hypogymnia* and section *Xanthoparmelia* of *Parmelia*, both of which have a subnitid lower cortex while our species is very dull. Unfortunately our species lacks both apothecia and spermogonia. In thalline anatomy our species is much closer to *Hypogymnia* than to section *Xanthoparmelia*. *Hypogymnia* is also more characteristic of very high elevations than is *Xanthoparmelia*.

TANGANYIKA: Mt. Kilimanjaro, between saddle and Kibo, 4830–5475 m., on volcanic rock, *B. Verdcourt & M. Wilkinson 1228*, in E. Africa Herb.

Hypogymnia sp.

Type: Kenya, Mt. Elgon, Masaba, 4386 m., on rocks in alpine meadow, *A. S. Thomas 619* p. p. min. ex hb. Botanist, Dept. Agr. Uganda at Kew.

Thallus up to 10 mm. in diameter, branching more or less palmate, ultimate lobes up to 1.5 mm. long, 0.5 mm. broad, somewhat inflated, olive buff above, black-margined, underside black rugose; upper cortex 15 – 20 μ thick, of fastigiate

pseudoparenchyma, nearly hyaline; algal cells moribund, not clearly seen; medulla about 100 μ thick, the upper half of hyaline, slender, loosely woven hyphae, the lower half of loosely woven, branched, brown hyphae of greater diameter and thicker walls than those of the upper half; lower cortex 22–25 μ thick, very black, structure not clearly seen.

The Uganda fragments have more closely woven medullary hyphae and the brownish hyphae of the lower half of the medulla are heavily nubilated with minute granules. I have hesitated to give a name to this species as the specimens are moribund and very fragmentary.

KENYA: Mt. Elgon, Masaba, 4386 m., on rocks in alpine meadow, *A. S. Thomas 619* p. p. min. ex herb. Botanist, Dept. Agr. Uganda at Kew.

UGANDA: Imatory Mts., Ibahin, 1620 m. to Itibol 2060 m., on rocks, *A. S. Thomas 167* p. p. min. at Kew.

HYPOGYMNIA **deserti** (Hue) Dodge, comb. cov.

Parmelia physodes f. *deserti* Hue, Nouv. Arch. Mus. [Paris] IV. 1:124. 1899.

Type: South West Africa, Walvis Bay, near seashore on stones in desert, *Duparquet*.

PARMELIA

PARMELIA Ach., Meth. Lich. 153. 1803.

Imbricaria Ach., K. Vetensk. Akad. Nya. Handl. 15:250. 1794; Michaux, Fl. Bor.-Amer. 2:322. 1803.

Physcia S. F. Gray, Nat. Arr. Brit. Pl. 1:455. 1821, non Schreber, 1791, nor later authors.

Type: *Parmelia saxatilis* (L.) Ach.

Thallus monophyllous, appressed or margins ascending, lobes linear deeply divided almost to the center and appearing polyphyllous, often imbricate; upper surface smooth, rugose or sometimes scrobiculate, isidiose, or rarely sorediose, margins sometimes ciliate, isidiose, lobulate or sorediose; underside usually black, opaque in the center, often lighter at the margins of the lobes; rhizinae usually black, dense or sparse, covering the whole underside or confined to the central portion of the thallus; upper cortex fastigiate or of fastigiate pseudoparenchyma, usually thickwalled, more or less gelified; algae *Trebouxia*; medulla usually of longitudinal, relatively thickwalled hyphae, rarely arachnoid; lower cortex usually more or less pseudoparenchymatous, sometimes from fastigiate hyphae, sometimes from longitudinal hyphae, or of slender thinwalled brownish hyphae, little differentiated from those of the lower medulla in subg. Physcioideae on the Antarctic continent.

Apothecia superficial, sessile to short stipitate, disc concave at first, often becoming nearly plane, brownish, sometimes perforate; amphithecium well developed outside the hyaline parathecium which is usually of fastigiate thickwalled pseudoparenchyma, very rarely of thickwalled periclinal hyphae as in *Everniopsis*; paraphyses slender, septate, usually dichotomous above the asci; asci usually thinwalled with only the tip thickened when young, sometimes thickwalled, reminiscent of the

Pertusariaceae; ascospores hyaline, unicellular, ellipsoidal, very rarely spherical, usually with a thick epispore.

Spermogonia mostly oblate spheroidal, immersed in the thallus, rarely in bullate prominences resembling the pseudostromata of Pertusariaceae, or in the young amphithecium; wall thin, blackened about the ostiole, usually pale brown or hyaline below, of periclinal pseudoparenchyma; spermatiophores septate; spermatia lateral at the septa of the spermatiophores, straight, bacilliform to sub-bifusiform, rather short.

The genus is divided into three subgenera: Amphigymnia, lobes broad, rounded, margins with a broad (more than 3 mm. wide) nude zone, rhizinae usually sparse, stout; Euparmelia, lobes usually long and slender, rarely somewhat broader and rounded, with the underside covered by rhizinae to the margin or the outer rhizinae reduced to small dark papillae, usually slender, dense, often branched near the tips, sparse but short and slender in a few species of sect. Xanthoparmelia; and Physcioideae, lower cortex of slender longitudinal hyphae scarcely differentiated from the lower medulla except brownish and usually more closely woven, thus resembling the lower cortex of *Physcia*.

SUBGENUS EUPARMELIA

Parmelia subg. *Euparmelia* Nyl. in Hue, Revue de Bot. 4:375. 1885-6.

Type: *P. saxicola* (L.) Ach.

The subgenus is divided into three sections: Melaenoparmelia, thallus dark olivaceous brown to black; Xanthoparmelia, thallus yellowish green; and Hypotrachyna, thallus glaucous when fresh, drying grayish.

While in general the division of the subgenus *Euparmelia* into sections on the basis of color of the upper surface of the thallus is satisfactory, occasionally there is doubt. Sect. *Melaenoparmelia* seldom gives trouble, although rarely a moribund thallus of a species of the other sections may be blackened, but one can usually find a lobe or lobule which still retains its characteristic color. Sect. *Xanthoparmelia* is often more troublesome when working with old material. Characteristically the fresh moist thallus is "conspersa" green, deep lichen green of Ridgway, drying deep olive buff. Unfortunately many species of the glaucous to gray sect. *Hypotrachyna* become shades of olive buff in old specimens. Where I have been at all in doubt, I have included them in the key under each group. If dubious material is not identified in the key to one section, it should be looked for in the other.

SECT. MELAENOPARMELIA

Parmelia sect. *Melaenoparmelia* Hue, Nouv. Arch. Mus. [Paris] IV. 1:138. 1899; *Parmelia* subg. *Euparmelia* sect. *Melaenoparmelia* Zahlbr., in Engler & Prantl, Nat. Pflanzenfam. I. 1*:212. 1907.

Type: *P. stygia* (L.) Ach.

Thallus deep olive, chestnut to black; underside covered with rhizinae; apothecia sessile.

1. Medulla orange to reddish, lobes convex, fuscous or darker, fertile; North Congo.....
.....*P. erythrocardia* (Müll. Arg.) Vainio
1. Medulla white (or slightly yellowish in *P. Dregeana*).....2
2. Thallus subcrustose, center areolate with radial peripheral lobes (resembling *Lecanora* subg. *Squamaria*); South Africa.....3
2. Thallus clearly foliose 6
3. Ascospores about thrice as long as broad; medulla K yellow then red.....4
3. Ascospores about twice as long as broad.....5
4. Ascospores 8–11 × 3.5–4 μ; apothecia small.....*P. squamariata* Nyl.
4. Ascospores 9–10 × 3 μ; apothecia 2–4 mm. in diameter, margin entire, inflexed; medulla C yellow, KC red; saxicole.....*P. fissurina* Zahlbr.
5. Ascospores 7–8 × 3–6 μ; apothecia 5–7 mm. in diameter, margin subentire, subflexuous; medulla K yellow, C–, KC– .....*P. squamans* Stzbgr.
5. Ascospores 7–9 × 5–5.5 μ; apothecia up to 2.5 mm. in diameter, margin crenulate; medulla K yellow ferruginous, C yellow orange; saxicole.....*P. melancholica* Steiner & Zahlbr.
5. Ascospores 7–10 × 4–6 μ.....*P. prolixa* v. *applicata* Stzbgr.
5. Ascospores 10–14 × 5–7 μ; apothecia 0.5–2 mm. in diameter, margin crenulate, flexuous; medulla K yellow then red; lobes narrow, convex; underside stramineous or ochro-leucous.....*P. perplexa* Stzbgr.
6. Ascospores 9–15 × 3.5–4.5 μ; apothecia up to 1 mm. in diameter, margin subentire; medulla K yellow then red; lobes 0.5 mm. wide.....*P. prolixula* Nyl.
6. Ascospores 6–9 μ long, ellipsoid.....7
6. Ascospores under 6 μ in diameter, subspherical.....8
7. Thallus pale beneath, lobes short, turgid; apothecia 1.5–2.5 mm. in diameter, margin thin, entire; ascospores 6–9 × 4.5–6 μ; South West Africa.....*P. conturbata* Müll. Arg.
With subsorediose white points or lines above.....v. *exornata* Zahlbr.
7. Thallus ochro-fuscous beneath, lobes convex, dichotomous, lobules subcrenate; apothecial margin entire; ascospores 7–9 × 4–6 μ; medulla KC red; Transvaal.....*P. oleagina* Stzbgr.
7. Thallus fuscous beneath with black margins, lobes 3 mm. long; apothecia up to 2 mm. in diameter, margin entire; ascospores 8.5–9 × 6–7 μ; medulla K yellow, later red, C–, KC– or finally slightly red under the algal layer; saxicole; Cape of Good Hope.....
.....*P. van-der-Bijlii* Zahlbr.
8. Lobes 1 mm. wide, linear, dichotomous, subconvex; apothecia 1.5 (–2) mm. in diameter, margin subcrenulate; ascospores 5–6 × 5μ; medulla white or slightly yellowish, K–, C and KC rose-purple; saxicole; Cape of Good Hope.....*P. Dregeana* Hampe
8. Lobes 0.4–0.7 mm. wide, 3–5 mm. long, convex, pale below; apothecia 1–1.4 mm. in diameter, margin very thin, entire, exciple pale; ascospores 3.5–4 μ in diameter; medulla K yellow orange, C–, KC– or slowly yellowing; South West Africa.....
.....*P. namaensis* Steiner & Zahlbr.

PARMELIA (MELAENOPARMELIA) DREGEANA Hampe in Nyl., Syn. Meth. Lich. 1:398. 1860.

Type: Cape of Good Hope, on quartzose rock, *Drège*.

Thallus about 3 cm. in diameter, slate gray, tips of lobes grayish olive, lobes radiating, not imbricate, dichotomous, 0.5–1 mm. wide, tips truncate to retuse, flat to slightly convex, surface smooth, underside honey yellow with scattered tufts of slender, dark rhizinae, densely branched at the tips; upper cortex 15 μ thick, outermost cells 5 × 3 μ with thick greenish black walls, the rest hyaline, of thinwalled, dichotomous vertical hyphae about 3 μ in diameter; algal layer 30 μ thick of single colonies up to 4 cells, widely scattered between the subvertical medullary hyphae, cells 11–12 μ in diameter; medulla K–, C rose-purple, KC rose purple, 100–115 μ thick, of very loosely woven hyphae with large air spaces especially in the middle, more longitudinal and closely woven under the algal layer and next the lower cortex; lower cortex pale brownish to hyaline, gelified, 7–10 μ thick, of pseudoparenchyma from longitudinal hyphae, 3.5–5 μ in diameter.

Apothecia sessile, up to 2 mm. in diameter, margin minutely crenulate, somewhat incurved, exciple nearly chamois, smooth; disc shining, auburn or darker; amphithecial cortex 55(–60) μ thick, gelified, outer half fastigiate, lumina about

1 μ in diameter, inner half nearly periclinal; algal layer of a few scattered cells about 30–50 μ inside the medulla, apparently dying out below; medulla very loosely woven, almost arachnoid, tearing badly in sectioning; parathecium 15 μ thick, gelified, of fastigiate pseudoparenchyma, protoplasts spherical, about 1 μ in diameter; hypothecium about 15 μ thick, of slender, thickwalled periclinal hyphae, conglutinate; thecium 65 μ tall; paraphyses slender, closely septate, branching above the asci, the ends of the branches moniliform in the brownish epithecial gel; asci clavate, 45 $\times$ 10 μ, wall and tip about 3 μ thick; ascospores subspherical, 5–6 $\times$ 5 μ.

At first sight this species looks like a dark gray *Physcia*, but anatomically it is clearly a *Parmelia*.

CAPE OF GOOD HOPE: Simon's Bay, saxicole, *Charles Wright*, U. S. North Pacific Exploring Exp. sub *P. conspersa* "CaCl roseo-purp." in Tuckerman Herb. at Farlow Herb.

SECT. XANTHOPARMELIA

Parmelia sect. *Xanthoparmelia* Vainio, Etude Lich. Brésil 1:60. 1890.
Parmelia subg. *Euparmelia* sect. *Xanthoparmelia* Zahlbr. in Engler & Prantl, Nat. Pflanzenfam. I. 1*:212. 1907.

Type: *P. conspersa* Ach.

Thallus usually appressed to the substrate, yellowish green; lobes eciliate, underside usually black, but more often pale with pale rhizinae than in sect. Hypotrachyna, covered completely with rhizinae, although they are sparse but short and slender or in small discrete groups in some species; medulla usually white, but is pink to cinnabar or pale yellowish to orange in a few species; apothecia superficial, small, sessile constricted at the base, rarely very slightly substipitate, disc imperforate; parathecium of fastigiate hyphae or pseudoparenchyma (except in *P. Eylesii*); asci usually thinwalled with tips thickened when young with a few species having walls up to 2 μ thick; ascospores small, under 11 μ long. Spermogonia of the usual type, but immersed in bullate prominences resembling the pseudostromata of *Pertusaria*, in *Parmelia bipindensis* and *P. concolor*.

1. Medulla red or at least rose maculate 2
1. Medulla some shade of yellow, at least in upper part 3
1. Medulla white (or color not given and presumed white) 6
   2. Medulla cinnabar red, sometimes only rose or rose maculate, K violascent, C violet, KC evanescent violet; surface smooth; underside pale; apothecia 2 mm. in diameter, margin subcrenate; ascospores 8–10 $\times$ 6 μ; spermatia 6 $\times$ 0.6–0.7 μ; saxicole ..... *P. endomiltoides* Nyl.
   2. Medulla rose, K yellow then red, KC red; lobes with cylindric then flattened microphylline "isidia" 10–15 mm. long ..... *P. pseudoconspersa* Gyelnik
3. Thallus isidiose asperate, at least toward the center 4
3. Thallus sorediose, soralia 2–4 mm. in diameter on central lobes; underside black; lobes 5–10 mm. wide; sterile; Réunion ..... *P. albidostraminea* Hue
3. Thallus without isidia or soredia 5
   4. Medulla partly white, partly orange yellow, K yellow, C–, KC red; isidia verrucose, ovoid; lobes appressed, 1–1.5 mm. wide, branched; underside fuscous; North Congo ..... *P. endochrysea* (Müll. Arg.) Gyelnik
   4. Medulla clay-color maculate, K red, C–, KC red; lobes plane; underside pale; saxicole; Zanzibar ..... *P. adplanata* v. *isidiigera* Müll. Arg.
5. Medulla clay-color maculate, K red, C–, KC red; lobes plane; underside pale; saxicole; Zanzibar ..... *P. adplanata* Müll. Arg.
5. Medulla pale lemon yellow, K–, C evanescent orange; KC–; underside buffy brown with very pale rhizinae; central lobes bullate with many spermogonia; marginal lobes pinnate, very revolute; corticole; Cameroons ..... *P. bipindensis* Dodge

5. Medulla deep colonial buff, K orange, C orange, KC–; underside brown with dark rhizinae; marginal lobes dichotomous; saxicole; Cape of Good Hope.....*P. Taylori* Dodge
5. Medulla pale citrine, K–, C–, KC orange red; underside black; marginal lobes 4–6 mm., subrotund; apothecial margin thick; ascospores spherical, 8 μ in diameter; Réunion.....*P. sphaerospora* Nyl.
6. Thallus isidiose 7
6. Thallus sorediose 13
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8. Medulla K–, C– 9
8. Medulla K–, C rose, KC faint pink; lobes 2–3 (–5) mm. wide; apothecia up to 7 mm. in diameter, exciple isidiose; ascospores 10–13 × 5–6.5 μ; corticole; Guinée.....*P. djalonensis* des Abb.
8. Medulla K yellow, red next the algal layer, C–, KC rose; lobes rounded; exciple isidiose; Réunion.....*P. Gyelniki* Dodge
9. Medulla KC reddish violet; isidia coralloid; apothecia 7 mm. in diameter, exciple isidiose; ascospores 10–11 × 5 μ; Cape of Good Hope.....*P. perisidiosa* Nyl.
9. Medulla KC violet, lobes rounded; sterile; Nyasaland; belongs in subg. *Amphigymnia*.....*P. ecaperata* Müll. Arg.
9. Medulla KC wine red; lobes 1.5–2 (–2.5) mm. wide, linear, tips truncate; isidia mostly simple, a few coralloid; apothecia 2 mm. in diameter, exciple smooth or slightly isidiose; sparsely rhizinose below; ascospores 7–8 × 4.5–5.5 μ; corticole; Côte d'Ivoire.....*P. abstrusioides* des Abb.
9. Medulla KC–; lobes ciliate, 10–12 mm. wide, terricole; Madagascar..*P. xanthina* (Müll. Arg.) Vainio
9. Medulla KC–; lobes eciliate, up to 15 mm. long, 3–4 mm. wide; underside Saccardo's umber to clay color; rhizinae in scattered groups; sterile; Mauritius.....*P. subhypoclysta* Dodge
10. Medulla K– 11
10. Medulla K pale yellow, C–, KC–; corticole; Mozambique.....*P. mozambica* Vainio
10. Medulla K yellow then red.....12
10. Medullar reaction unknown; thallus 3–5 cm. in diameter, lobes radial, 0.5 mm. wide; rhizinae rare; apothecia less than 1 mm. in diameter; ascospores 7–9 × 3–4 μ; on quartz; Congo.....*P. congensis* Stein
11. Medulla C evanescent pink, KC–; thallus membranous; Sierra Leone.....*P. njalonensis* Dodge
11. Medulla C red; thallus fragile, lobes not radiating; isidia often breaking down into soredia; corticole; Cape of Good Hope.....*P. aleuriza* Vainio
12. Medulla KC slightly rose; lobes dichotomous, 1–2 mm. wide; sterile; corticole; Comoro Islands, Kenya and Uganda.....*P. Decaryana* Gyelnik
12. Medulla KC fusco-red; lobes short, crenate or sinuate dissected; apothecia 3–7 mm. in diameter, margin thick; ascospores 18–26 × 11–15 μ; saxicole; Cape of Good Hope.....*P. xanthotropa* Stirton
13. Medulla K–, C red; corticole; S. Africa.....14
13. Medulla K yellow then red, C–, KC–; lobes very narrow, 10 × 1 mm.; central lobes much smaller; soralia large, superficial; St. Helena.....*P. Wildeae* Dodge
14. Thallus ashy yellow, black below, isidiose at first, isidia breaking down into minute soredia; fertile.....*P. aleuriza* Vainio
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17. Medulla K–, C–; apothecia up to 2 mm. in diameter; ascospores 10–13 × 6–7 μ; spermatia 5–5.5 × 0.5–0.7 μ; marginal lobes 3–7 × 1–2 mm., 2–3-chotomous; saxicole; Cape of Good Hope.....*P. Brunnthaleri* Steiner & Zahlbr.
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17. Medulla K yellow then red, C–, KC red.....19
18. Apothecia 0.3–1.5 mm. in diameter; ascospores 8–10 × 4–6 μ; thallus pale sulfur color.....*P. perspersa* Stzbgr.
18. Apothecia 0.5–0.7 mm. in diameter; ascospores 9–11 × 5–7 μ; saxicole.....*P. adhaerens* Nyl.
18. Apothecia 0.3–1 mm. in diameter; ascospores 14–15 × 5–6 μ; lobes on a black hypothallus without rhizinae, probably a true *Lecanora*.....*P. interrupta* Stzbgr.
19. Apothecial disc bay; thallus lobes 3–4 × 2 mm., probably ashy sulfur at first, darkening to steel green or fuscous olive; rhizinose below.....*P. chalybeizans* (Steiner & Zahlbr.) Gyelnik
19. Apothecial disc chestnut, up to 1.5 mm. in diameter; ascospores 7–8 × 6 μ; spermatia 5–6 × 0.6–0.7 μ; thallus lobes 2 mm. wide, conspersa green, drying deep olive buff; sparsely rhizinose below.....*P. conspersula* Nyl.

20. Underside dark fuscous to black....21
20. Underside red brown, margins stramineous yellow; lobes 1–2 mm. wide, transversely rugose and rimose below, tips multifid, nearly terete; rhizinae on distal portions of lobes; apothecia 6–8 mm. in diameter, substipitate, margin inflexed; Cape of Good Hope....*P. leonora* v. *multifida* Fw.
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21. Medulla K yellow; terricole or saxicole; S. Africa....26
21. Medulla K yellow then red, C–, KC rose to red....28
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23. Ascospores under 7 μ long....24
23. Ascospores over 11 μ long; belong in *Amphigymnia*....25
24. Apothecia 1–2.5 mm. in diameter; ascospores 6.5–7 × 3.25–3.5 μ; disc chestnut; underside black, sparsely verrucose, rhizinae not seen; thallus reed yellow, lobes irregularly dichotomous; medulla KC–; Mauritius....*P. Wightii* Dodge
24. Apothecia 2 mm. in diameter; ascospores 7 × 5 μ; disc auburn; underside black, minutely rugulose, rhizinae scattered; thallus deep olive buff, lobes subpinnate; medulla KC red; Angola....*P. benguellensis* (Vainio) Dodge
25. Apothecia 2–6 mm. in diameter; ascospores 12–16 × 6–8 μ; disc pale flesh to pale yellow; South Africa....*P. amplexa* Stirton
25. Apothecia 7–9 mm. in diameter; ascospores 11 × 6 μ; disc chestnut; underside black with buckthorn brown margins, nude of rhizinae in the outer 3 mm.; Portuguese East Africa; belongs in *Amphigymnia*....*P. inhaminensis* Dodge
26. Disc chalky pruinose; lobes 2 mm. wide, rounded, yellow green; medulla C–, KC red; apothecia 2 mm. in diameter, margins thick, radially verrucose; ascospores 10–12 × 8 μ; corticole; Tanganyika....*P. glaucopis* (Müll. Arg.) Vainio
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27. Lobes 0.5–4 mm. wide, yellow green; medulla C–, KC red; underside sparsely rhizinose, lobes transversely cracked, subareolate in the center, black margined; saxicole; South West Africa....*P. Schenckiana* Müll. Arg.
27. Lobes 1.5–2 mm. wide, white reticulate, yellow; medulla C–, KC red; rhizinae few and short; saxicole; Cape of Good Hope....*P. hypoleioides* Vainio
27. Lobes pale sulfur stramineous, pinnate or crenate incised; apothecia up to 1 mm. in diameter; ascospores 9–11 × 3–4 μ; spermatia 7 × 0.5 μ; saxicole; Transvaal..*P. saxeti* Stzbgr.
28. Lobes subcylindric, 0.25–0.5 mm. in diameter, densely imbricate, conspersa green; rhizinae rare; sterile; Madagascar....*P. Benyovszkyana* Gyelnik
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29. Ascospores 8–10 × 6–7 μ; apothecia 7 mm. in diameter; lobes 2–5 mm. wide, ultimate lobules 1–2 mm. wide; terricole; Cape of Good Hope....*P. stenotera* (Stirton) Dodge
29. Ascospore size unknown; apothecia up to 4 mm. in diameter; lobes linear, long, 1 mm. wide, plane or convex; terricole; Madagascar....*P. tananarivensis* Gyelnik
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30. Medulla K– 31
30. Medulla K yellow, sometimes slowly; terricole or saxicole; S. Africa....33
30. Medulla K yellow then pink or red....38
31. Medulla KC dirty pink above, negative below, C–; upper surface K–; apothecia 3–4 mm. in diameter, margin thick, subentire; ascospores 8–11 × 5.5–7 μ; saxicole; Cape of Good Hope....*P. austroafricana* Stirton
31. Medulla KC– 32
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32. Apothecia 6 mm. in diameter, disc chestnut; ascospores 7 × 5 μ; saxicole; S. Rhodesia ....*P. Eylesii* Dodge
32. Apothecia 5 mm. in diameter, disc Brussels brown; ascospores 6–7 × 5–6 μ; corticole; S. Africa....*P. concolor* Sprel.
33. Underside pale ochraceous; saxicole; Cape of Good Hope....34

33. Underside testaceous, darker toward the center, lobes 1–3 mm. wide, subdichotomous, partly black margined; medulla KC rose soon fading; S. Africa.....*P. subconspersa* v. *africana* Gyelnik
33. Underside pale to pale fuscous.....35
34. Medulla C pink, KC pink; lobes 5–7 × 3–5 mm., tips crenulate incised; apothecia 2–4 mm. in diameter; ascospores 8.5–9 × 5–5.5 μ.....*P. Worcesteri* Steiner & Zahlbr.
34. Medulla C yellow, KC orange ferruginous; lobes 0.8–1.3 × 0.6 mm., transversely rugose; apothecia absent.....*P. amphixanthoides* Steiner & Zahlbr.
34. Medulla C–, KC pale yellow; lobes 1–1.5(–2) mm. wide; apothecia subelevated; ascospores 8 × 5 μ.....*P. subdecipiens* Vainio
35. Sterile.....36
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36. Lobes 1–1.5 mm. wide, black margined; medulla C–, KC red; Cape of Good Hope.....*P. citrinireagens* v. *angustior* Gyelnik
36. Lobes 2–4 × 0.7–0.8 mm., subpinnatifid, yellow ashy, convex, sparsely rhizinose below; medulla C–, KC–; saxicole; Socotra.....*P. convexula* Müll. Arg.
37. Apothecia substipitate, 5–10 mm. in diameter, margin incurved, deeply incised crenate; disc rufous chestnut; ascospores 7 × 3 μ; medulla C–, KC–; Cape of Good Hope.....*P. leonora* Sprgl. in Mass.
37. Apothecia 5 mm. in diameter, margins connivent, deeply incised crenate; ascospores 9–11 × 4–6 μ; central lobes corniculate; medulla KC–; S. Africa.....*P. chlorea* Stzbgr.
37. Apothecia sessile to slightly elevated, margin crenate; ascospores 10–12 × 6–7 μ; center of thallus bullate; medulla KC slightly reddening; saxicole; Cape of Good Hope.....*P. ceresina* Vainio
38. Medulla KC– or rose; lobes 30–35 × 5–8 mm., dirty bay below, almost erhizinose; apothecia 6 mm. in diameter; ascospores 10 × 5–6 μ; terricole; Cape of Good Hope.....*P. terricola* Steiner & Zahlbr.
38. Medulla C–, KC evanescent red; apothecia 3–7 mm. in diameter, margin smooth; ascospores 8–10 × 5–6 μ; terricole; S. Africa.....*P. phaeophana* Stirton
38. Medulla KC rose; lobes 3–4 mm. wide; S. Africa.....*P. phaeophana* f. *protoimbricatoides* Gyelnik

PARMELIA (XANTHOPARMELIA) ENDOMILTODES Nyl. in Crombie, Jour. Linn. Soc. Bot. **15**:168. 1876.

Parmelia conspersa v. *endomiltodes* Müll. Arg., Flora **74**:378. 1891.

Type: Cape of Good Hope, Table Mt., saxicole, *A. E. Eaton*, Venus Transit Exp.

Thallus 3–8 cm. in diameter, caespitose, growing over other thalli and covering much larger areas, citrine drab to deep olive buff, lobes about 6 mm. long, 2.5–3 mm. wide below, subflabellate, ultimate lobules 1–1.5 mm. long, 0.4–0.6 mm. wide, branching dichotomous with rounded sinuses, very imbricate, irregularly arranged not radiating at the margin, peripheral lobes closely attached to the rock, central lobes probably suberect, surface smooth, subnitid; underside black usually to the margins of the lobules, occasionally lighter at the margins, densely covered with short, simple rhizinae; upper cortex about 12 μ thick, of thickwalled fastigiate pseudoparenchyma, protoplasts about 1 μ in diameter, more deeply staining and nubilated with brownish granules in the lower half (covered with collapsed longitudinal hyphae, probably the remains of a mold, 6–8 μ thick); algal layer 30 μ thick, continuous or nearly so, cells 5–6 μ in diameter, occasionally penetrating the upper medulla; medulla K yellow ferruginous, C–, KC deep orange ferruginous in the white portions, K orange red, C bleached to rose, KC very deep orange ferruginous with an evanescent deep violet shade in the rose to cinnabar portions, 210–220 μ thick, rather loosely woven, closer and more longitudinal in the lower

40 μ, hyphae 3 μ in diameter, relatively thinwalled; lower cortex 15 μ thick, of thinwalled fastigiate pseudoparenchyma, cells 3 μ in diameter.

Apothecia 2 mm. in diameter, cupulate, margin thick, entire, inrolled, exciple smooth; disc burnt sienna; amphithecial cortex 30 μ thick, of fastigiate pseudoparenchyma, protoplasts about 2 μ in diameter; algal layer 30 μ thick, continuous, cells 8–9 μ in diameter; medulla loosely woven, hyphae heavily nubilated in the middle third; algal layer under the parathecium 40 μ thick, continuous, cells 8–10 μ in diameter; parathecium 20 μ thick, of fastigiate pseudoparenchyma, protoplasts 2.5 μ in diameter, more deeply staining above; hypothecium 30 μ thick, of slender, moderately thickwalled periclinal hyphae, deeply staining above and below with a hyaline zone in the middle about 8 μ thick; thecium 40 μ tall; paraphyses slender, septate, unbranched or occasionally once or twice dichotomous above the asci, tips not thickened, reaching the surface of the brownish epithecial gel; asci clavate 30 $\times$ 10–11 μ, 8-spored, tip only slightly thickened when young; ascospores ellipsoid, 8–10 $\times$ 6 μ.

CAPE OF GOOD HOPE: Table Mt. saxicole, *A. E. Eaton,* Venus Transit Exp. at Kew, a portion of the type collection; without definite locality, *T. Cooper* det. *P. conspersa* var. *endomiltodes* Müll. Arg. by Müller-Argau at Kew.

PARMELIA (XANTHOPARMELIA) ENDOCHRYSEA (Müll. Arg.) Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] **29**:288/416. 1931.

Parmelia adpressa v. *endochrysea* Müll. Arg., Flora **62**:289. 1879.

Type: Congo, Nyam Nyam, Bendo, Gumango, *Schweinfurth*; Mt. Baginse, on gneiss, *Schweinfurth.*

Thallus 8–9 cm. in diameter, deep olive buff to wood brown, peripheral lobes about 10 mm. long, 4–5 mm. broad, some rounded, shallowly crenate, others more deeply lobed with rounded to excised sinuses, imbricate, central lobes slightly smaller but similar, surface smooth to slightly impressed and rugose, reticulate rimulose; isidia not abundant, simple, up to 0.5 mm. long, abundant on a few central lobes, rare on most; underside opaque, black to the margin or shading to chestnut and subnitid; rhizinae covering the whole underside, moderately dense, short, slender, simple, several uniting to form small disciform holdfasts in contact with the rock; upper cortex 10 μ thick, of gelified fastigiate pseudoparenchyma, protoplasts about 1 μ in diameter, not nubilated; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter; medulla white, becoming deep orange in large areas, white areas K slowly yellow then rapidly orange red, C–, KC rapidly yellow then orange red, 35 μ thick, of moderately closely woven longitudinal hyphae, looser next the algal layer and the lower cortex, very heavily nubilated with grayish granules; lower cortex 15 μ thick, brownish, gelified, pseudoparenchymatous from longitudinal hyphae; rhizinae about 40 μ in diameter, formed by outgrowth of hyphae from the lower cortex.

Apothecia immature, about 0.5 mm. in diameter, ureceolate, margin crenulate, inrolled, exciple smooth; not sectioned.

As I have not seen Müller-Argau's types, the identification of our specimen is somewhat uncertain. The orange areas in our specimen are rather extensive and if Müller Argau had specimens from such portions of the thallus, our material

agrees with his description. The orange red color seems to be associated with moribund parts of the thallus.

CONGO: Kahusi, 2700 m., growing over mosses, *F. L. Hendrickx 4307* in the E. African Herb.

PARMELIA (XANTHOPARMELIA) ADPLANTA Müll. Arg., Flora 68:502. 1885.

Type: Zanzibar, near Mombasa, on sandstone, *J. M. Hildebrandt 1962* p. p.

Thallus probably 4 cm. in diameter, between lichen green and deep lichen green, lobes about 10 mm. long, 1 mm. wide, irregularly dichotomous below, subpinnate above with acute to rounded sinuses, ultimate lobes 1 mm. wide and long, rounded, tips sometimes nearly truncate, surface smooth, subnitid, cortex and algal layer easily cracking away, exposing the medulla; underside black, densely rhizinose ("subtus subpallidae" apparently from an upturned lobe where the lower cortex had scaled away), buckthorn brown, reticulate rugulose, nude in the outer 1.5 mm.; upper cortex 12 μ thick, of fastigiate pseudoparenchyma, cells 4 μ in diameter, very heavily nubilated with dark brownish granules; algal layer of close discrete colonies of *Trebouxia* 15 μ in diameter, cells 4–5 μ in diameter; medulla warm buff, K rufescent, C–, KC slowly rufescent, 100 μ thick, upper 30 μ of moderately closely woven longitudinal hyphae 3 μ in diameter, heavily nubilated with brownish granules, the rest arachnoid, of oblique and subvertical hyphae with large air spaces; lower cortex 10 μ thick, of two layers of isodiametric cells 4–5 μ in diameter, very thickwalled, lumina about 2 μ, outer layer dark brown, inner layer hyaline.

ZANZIBAR: near Mombasa, on sandstone, *J. M. Hildebrandt 1962* p. p. a portion of the type collection, at Kew.

Var. **isidiigera** (Müll. Arg.) Dodge, comb. nov.

Parmelia adplanta f. *isidiigera* Müll. Arg., Flora 68:502. 1885.
Parmelia isidiigera Vainio, Mem. Herb. Boissier 6:6. 1900.

Type: Zanzibar, near Mombasa, on ferriferous sandstone, *J. M. Hildebrandt 1962* p. p.

Central portion of thallus densely isidiose, isidia 0.4 mm. long, mostly simple, rarely dichotomous; otherwise as in the type of the species.

ZANZIBAR: near Mombasa, on ferriferous sandstone, *J. M. Hildebrandt 1962* p. p. at Kew, portion of the type collection.

PARMELIA (XANTHOPARMELIA) **bipindensis** Dodge, sp. nov.

Type: Cameroun, Bipinde, in primaeval forest, corticole, *G. Zenker 4053* p. p. min. at Kew.

Thallus foliosus, laevis, citrino-ravus, marginibus olivaceo-alutaceis, lobis 10 × 2 mm., pinnatim ramosis, revolutis, centro bullatus, multis cum spermogoniis, subtus alutaceo-brunneus, reticulatim rugosus, rhizinis pallidis; cortex superior 25–30 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 6–7 μ diametro; stratum algarum 20–25 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K–, C evanescenter aurantiaca, KC–, dilute flavida, 250 μ crassi-

tudine, hyphis verticalibus, laxe contextis, 3–4 μ diametro, nubilatis; cortex inferior brunneus, 16–20 μ crassitudine, pseudoparenchymatice fastigiatus.

Apothecia sessilia, imperforata, 4–5 mm. diametro, marginibus crenatis, involutis, disco brunneo umbrinove; cortex amphithecialis 30 μ crassitudine; stratum algarum 45–50 μ crassitudine, coloniis discretis; medulla laxa sed densior quam in thallo; stratum algarum sub parathecio 30 μ crassitudine, continuum, nubilatum, cellulis 7–8 μ diametro; parathecium 25 μ crassitudine, pseudoparenchymatice fastigiatum, cellulis 2 μ diametro; hypothecium 50 μ crassitudine, hyphis periclinalibus; thecium 55–60 μ altitudine; paraphyses tenues, apicibus non incrassatis; asci clavati, 45–50 $\times$ 12–13 μ, apicibus subincrassatis; ascosporae octonae, ellipsoideae, 6.5 $\times$ 4 μ, episporio crasso.

Thallus foliose, smooth, center citrine drab, margins olive buff, marginal lobes 10 $\times$ 2 mm., pinnately branched, very revolute, central portion bullate with many spermogonia (giving the appearance of a pseudostromata of a *Pertusaria*); underside buffy brown with very pale rhizinae, reticulately rugose and minutely scrobiculate; upper cortex 25–30 μ thick, of fastigiate pseudoparenchyma, cells 6–7 μ in diameter; algal layer 20–25 μ thick, of discrete colonies and single cells of *Trebouxia*, cells 6–7 μ in diameter; medulla pale lemon yellow, K–, C evanescent orange, KC–, 230 μ thick, of loosely woven, predominantly vertical hyphae, 3–4 μ in diameter, heavily nubilated with brownish granules, especially in the axils of the hyphal branches; lower cortex brownish, 16–20 μ thick, of fastigiate pseudoparenchyma.

Apothecia sessile, imperforate, 4–5 mm. in diameter, margin coarsely crenate, involute, exciple smooth, disc Brussels brown to raw umber; amphithecial cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 6–7 μ in diameter; algal layer 45–50 μ thick, of discrete colonies with occasional cells deep in the medulla; medulla loosely woven but much denser than the thalline medulla, heavily nubilated under the subparathecial algal layer; algal layer under the parathecium 30 μ thick, continuous, cells 7–8 μ in diameter, heavily nubilated with minute brownish granules; parathecium 25 μ thick, of fastigiate pseudoparenchyma, protoplasts 2 μ in diameter; hypothecium 50 μ thick, of slender periclinal hyphae; thecium 55–60 μ tall; paraphyses slender, tips not thickened, ending in the brownish epithecial gel; asci clavate, 45–50 $\times$ 12–13 μ, tips slightly thickened; ascospores short ellipsoidal, 6.5 $\times$ 4 μ, with a rather thick epispore.

The arrangement of the hyphae in the hypothecium suggests that the thecium is formed by many ascogonia, in one section the thecium from a single ascogonium appears to be about 250 μ in diameter.

CAMEROUN: Bipinde, in primaeval forest, corticole, *G. Zenker 4053* p. p. min., type, at Kew.

ANGOLA: Maiombe, Chiluango, corticole, *J. Gossweiler*, at Kew.

Parmelia (Xanthoparmelia) Taylori Dodge, nom. nov.

Parmelia mutabilis Taylor, London Jour. Bot. 6:171. 1847 non Fr.
Omphalodium mutabile Minks, Mém. Herb. Boiss. 21:86. 1900.

Type: Cape of Good Hope, Uitenhage, saxicole, *Zeyher 5*, ex Hooker Herb. in Taylor Herb. at Farlow Herb.

Thallus at least 4 cm. in diameter, probably larger, lobes variable, some up to 3 mm. broad and long, more about 1 mm. wide and up to 4 mm. long, the longer irregularly dichotomous, tips truncate to rounded, one thallus between citrine drab and dark olive buff, the other between citrine drab and buffy brown (after more than a century in the herbarium), very narrowly black margined; underside dark fuscous brown, paler toward the margin which appears nude (Taylor describes as "nigrovillosis" but the type is so closely glued to the herbarium sheet that the rhizinae are not visible); upper cortex 20 μ thick, outer 3 μ amorphous, below which is a layer of fastigiate, cylindric cells 10 $\times$ 4 μ, walls gelified, covered with minute deep brown granules, the lower 7 μ of isodiametric cells 4 μ in diameter, apparently from periclinal hyphae but somewhat irregularly arranged; algal layer 15–20 μ thick, of discrete colonies of *Trebouxia*, cells 5–6 μ in diameter, partly subcontinuous; medulla chamois to deep colonial buff, nearly olive ochre in thick sections, a little paler next the lower cortex, K slowly orange, C slowly orange, KC–, 100–150 μ thick, arachnoid in the upper 20 μ with large air spaces, the rest very densely woven becoming more longitudinal in the lower 20 μ, hyphae about 4 μ in diameter, very heavily nubilated with pale brownish granules; lower cortex fastigiate, 13–15 μ thick, lumina 1 μ in diameter, highly gelified; rhizinae 50–60 μ in diameter formed by outgrowth of the lower cortex.

Apothecia up to 3 mm. in diameter, sessile, margin at first entire becoming crenate, incurved, exciple smooth, disc rufous becoming deep auburn; amphithecial cortex 40 μ thick, fastigiate, hyphae 6–7 μ in diameter, protoplasts 1 μ; algal layer 35 μ thick, of discrete colonies; medulla deep orange; algal layer under the parathecium 65–70 μ thick, continuous except under the margin; parathecium 40 μ thick, fastigiate, hyphae 6–7 μ in diameter, protoplasts 1 μ; hypothecium 15 μ thick, of slender periclinal hyphae, deeply staining; thecium 35 μ tall; paraphyses conglutinate, septate, tips slightly clavate, brownish; asci broadly clavate, about 33 $\times$ 13 μ, thickwalled, tips slightly thickened, 8-spored; ascospores broadly ellipsoidal, 8 $\times$ 5 μ, with a thin epispore.

Glued to the sheet with the type in Taylor's herbarium are two other thalli from Uitenhage, *Zeyher 22* and *66*, but neither seems to have contributed characters to Taylor's original description. I do not understand Taylor's phrases "gemmis marginalibus" and "demum gemmis crenulato." Taylor usually uses "gemma" in the sense of soredia, or perhaps isidia, while here it seems to refer to small lobules which he usually calls "propagula." Tuckerman identified all three as *P. conspersa* with a note "varying no little in South Africa." If Müller Argau borrowed the type sheet, he did not annotate it.

CAPE OF GOOD HOPE: Uitenhage, saxicole, *Zeyher 5*, ex Hooker Herb. in Taylor Herb. at Farlow Herb., type; Simon's Bay, saxicole, *Charles Wright*, North Pacific Exploring Exp. in Tuckerman herb. sub *P. conspersa*, at Farlow Herb.

PARMELIA (XANTHOPARMELIA) DJALONENSIS des Abb., Bull. Inst. Franç. Afrique Noire 13:966. 1951.

Type: Guinée Française, Fouta-Djalon à Dalaba (cercle de Mamou), 1200 m., on trunk of *Panara excelsa, H. des Abbayes.*

Thallus up to 10 cm. in diameter, stramineous yellow (between dark olive buff and deep olive buff in our Nigerian specimens about 100 years old), marginal lobes 20–25 mm. long, 1–2.5 mm. wide, irregularly subpinnate from irregular dichotomies with short internodes, sinuses rounded, surface smooth, dull, K yellow; central lobes shorter, very irregular, densely isidiose, isidia slender, mostly simple, black tipped, some dichotomous or coralloid, quite fragile, margins smooth, eciliate, sometimes isidiose; underside black, verrucose or rugose; rhizinae sparse in the center, denser on the peripheral lobes and lobules, almost erhizinose at the margin, very short, ending in subspheric holdfasts; cortex 15 μ thick, of fastigiate pseudoparenchyma, relatively thinwalled, slightly nubilated with brownish granules; algal layer 30 μ thick, of close colonies, nearly continuous, cells 7–8 μ in diameter; medulla K–, C pink (faint and developing slowly in our specimens), KC–, 80 μ thick, of predominantly longitudinal, moderately closely woven hyphae, looser in the lower half, 3–4 μ in diameter, not nubilated; lower cortex about 20 μ thick, pseudoparenchymatous, cells about 7 μ in diameter, with thick, dark brown walls.

Apothecia up to 5 mm. in diameter, sessile, cupulate becoming flattened, margin entire at first, soon minutely crenulate and short isidiose; exciple densely short isidiose, disc cinnamon rufous becoming chestnut brown in age; amphithecial cortex 40 μ thick, of very thinwalled, fastigiate pseudoparenchyma, protoplasts about 2 μ in diameter; algal layer of a few scattered colonies, 30 μ in diameter; medulla very loosely woven and easily tearing on sectioning; algal layer under the parathecium about 40 μ thick, continuous, cells very closely packed; parathecium 40 μ thick, of small-celled, fastigiate pseudoparenchyma, the hyphae much less conglutinate than in the amphithecial cortex; hypothecium 25 μ thick, of periclinal thinwalled hyphae 2 μ in diameter; thecium 55 μ tall; paraphyses septate, dichotomous above the asci, branches submoniliform, tips not thickened, ending about 6 μ below the surface of the brown epithecial gel; asci cylindric-clavate, 32–35 $\times$ 8 μ, wall thin; ascospores ellipsoid, 10–13 $\times$ 5–6.5 μ.

The Uganda specimen has much shorter, less dense isidia and the marginal lobes are shorter and somewhat narrower, but it agrees microscopically with the Nigerian material.

NIGERIA: *Charles Barter 1434*; Nupe, *Charles Barter*, both corticole from Niger Exp. at Kew.

UGANDA: Kibango, 1290 m., on bark of *Albizzia Brownei*, *R. Dümmer 602*, at Kew.

PARMELIA (XANTHOPARMELIA) **Gyelniki** Dodge, nom. nov.

Parmelia conspersa v. *hypoclysta* f. *isidiosa* Müll. Arg., Flora 66:47. 1883.
Imbricaria conspersa v. *hypoclysta* f. *isidiosa* Jatta, Nuovo Giorn. Bot. Ital. N. S. 9:470. 1902.
Parmelia ambigua v. *isidiosa* Gyelnik, Ann. Mus. Nat. Hung. 30:125. 1936.

Type: Réunion, *Lepervanche*, com. Bornet.

Thallus 12–13 cm. in diameter, olive buff, peripheral lobes 35 mm. long, 7 mm. wide, margins crenate, twice or thrice dichotomous, ultimate lobes 6 mm. long, 2–3 mm. wide, sinuses excised, tips rounded, narrowly black margined, surface transversely rimose, faintly white reticulate, subverrucose with dense groups of

coralloid isidia 110 μ in diameter, up to 1 mm. tall, smooth, subnitid and irregularly rimulose on the ultimate lobes; underside ochraceous tawny to buckthorn brown, shining, with scattered groups (1–2 mm. in diameter) of dense branched rhizinae, margins nude for 1–2 mm.; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 3 μ in diameter, upper half heavily nubilated with brownish granules; algal layer 30–40 μ thick, nearly continuous, cells 6 μ in diameter; medulla K yellow with a narrow zone turning red next the algal layer, C–, KC yellow then red, 65–80 μ thick, of thickwalled longitudinal hyphae 4 μ in diameter, very closely woven in the upper 40 μ, looser below and arachnoid with large air spaces next the lower cortex; lower cortex brownish, 15 μ thick, of gelified fastigiate pseudoparenchyma, cells 6 μ in diameter, lumina about 1.5 μ.

Spermogonia developing at the top of the algal layer, oblate spheroid, 135 μ in diameter, 90 μ tall; still quite immature.

Apothecia with isidiose exciple, not seen.

CAPE OF GOOD HOPE: det. *P. conspersa* v. *hypoclysta* f. *isidiosa* Müll. Arg. by Müller Argau at Kew.

PARMELIA (XANTHOPARMELIA) XANTHINA (Müll. Arg.) Vainio, Etude Lich. Brésil 1:37. 1890.

Parmelia proboscidea v. *xanthina* Müll. Arg., Flora 67:616. 1884.
Parmelia perlata v. *xanthina* Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888/9:156. 1890.
Parmelia xanthina f. *isidiosa* Müll. Arg., Hedwigia 30:229. 1890.

Type: Madagascar, without locality, *J. M. Hildebrandt.*

Thallus at least 5 cm. in diameter, dark olive buff in the center, shading to olive buff at the margins, yellower when wet, lobes rounded, 10–12 mm. wide, 5–10 mm. long, deeply crenate, margins smooth, narrowly black, or minutely dentate, ciliate, cilia up to 1 mm. long, surface subscrobiculate to minutely rugulose, densely isidiose in the center, less so on the peripheral lobes, isidia slender, coralloid; underside black, densely rhizinose, some margins with a nude border 1 mm. wide, others minutely papillate to the margin; rhizinae slender, simple or branched, black; upper cortex 15 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells 3–4 μ in diameter, heavily nubilated with minute brownish granules; algal layer 15 μ thick, of close discrete colonies of *Trebouxia,* cells only 3–4 μ in diameter, a few cells deeper in the medulla; medulla K–, C–, KC–, 50 μ thick, of moderately closely woven dichotomous hyphae, predominantly longitudinal but many transverse hyphae also present, somewhat nubilated with hyaline granules; lower cortex 12–13 μ thick, of fastigiate pseudoparenchyma, lumina 1 μ in diameter, hyaline next the medulla, shading to very dark brown on the outside; rhizinae about 30 μ in diameter formed from the lower cortex.

While the habit suggests the *Subflavescentes* of *Amphigymnia,* the distribution of rhizinae on the underside clearly places it in *Xanthoparmelia.*

MADAGASCAR: Imerina, Andrangolaoka, terricole (quartz grains attached to rhizinae), growing over hepatics, *J. M. Hildebrandt,* Nov. 1880 ex herb. Sbarbaro at Farlow Herb.; Amboisha Prov., Mt. Ambohisamehary (Montagne de Dieu), 280–300 m., saxicole, *Savelle 6,* ex herb. E. C. Paris.

CAPE OF GOOD HOPE: probably near Somerset East, *P. MacOwan* sub *P. Perlata* v. *ciliata* f. *aspera* Müll. Arg. det. Müll. Arg. at Kew.

PARMELIA (XANTHOPARMELIA) **subhypoclysta** Dodge, sp. nov.

Type: Madagascar, Imerina, Andrangolaoka, saxicole or terricole (quartz grains adherent to underside), *J. M. Hildebrandt*, sub *P. conspersa* v. *hypoclysta* f. *isidiosa* Müll. Arg. ex Sbarbaro Herb. at Farlow Herb.

Thallus ad 6 cm. diametro, aquose viridis K flavescens, lobis ca. 15 mm. longitudine, inferne 3–4 mm. latitudine, irregulariter dichotomis, internodis brevibus, subpinnatis, sinibus rotundatis, lobulis ultimis ca. 2 mm. longitudine, 1 mm. latitudine, apicibus rotundatis; isidia subverrucosa aut breviter cylindrica, non ramosa, tenuia, in lobis centralibus densa, peripheric is sparsiora, non in lobulis ultimis nec marginibus; inferne umbrinus aut argillaceus aut cinnamomeo- aut roseo-alutaceus, subnitidus, lobis aliis nudis reticulato rugulosis, alteris varrucosis rhizinosisque; cortex superior 9–10 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 3 μ diametro, granulis brunneis nubilatus; stratum algarum 30 μ crassitudine, cellulis 6–7 μ diametro sparsis; medulla K–, C–, KC–, 80 μ crassitudine, hyphis longitudinalibus 3 μ diametro dense contextis, irregulariter granulis griseo-brunneis nubilatis; cortex inferior 12 μ crassitudine, fastigiatus, hyphis pachydermeis, 2 μ diametro, lumina sphaerica, 1 μ diametro.

Thallus up to 6 cm. in diameter, water green, K slowly yellow, lobes about 15 mm. long, 3–4 mm. wide below, irregularly dichotomous, with short internodes, subpinnate, sinuses rounded, narrowing at each dichotomy, ultimate lobules about 2 mm. long, 1 mm. wide, tips rounded, truncate or retuse; isidia from verrucose to short cylindric, not branched, slender, dense on the central portions, more scattered toward the periphery, absent from the ultimate lobules and never marginal; underside varying from Saccardo's umber to clay color, cinnamon buff or pinkish buff, subnitid, some lobes nude, reticulate rugulose, more often verrucose with occasional rhizinae growing out from the verrucae; upper cortex 9–10 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells about 3 μ in diameter, very heavily nubilated with brownish granules; algal layer 30 μ thick, continuous, cells 6–7 μ in diameter, not closely packed, between vertical medullary hyphae; medulla K–, C–, KC–, 80 μ thick, of closely woven longitudinal hyphae 3 μ in diameter, heavily but irregularly nubilated with grayish brown granules; lower cortex 12–13 μ thick, fastigiate, of thickwalled hyphae about 2 μ in diameter, lumina spherical, 1 μ in diameter.

This species differs from *P. Gyelniki* Dodge in longer, narrower lobes, darker underside and in chemical inactivity of the medulla. *Parmelia Gyelniki* has a medulla K yellow, C–, KC rose.

MAURITIUS: without locality nor collector, herb. Hookerianum at Kew.

MADAGASCAR: Imerina, Andrangolaoka, saxicole or terricole, (quartz grains adherent to underside), *J. M. Hildebrandt* sub *P. conspersa* v. *hypoclysta* f. *isidiosa* Müll. Arg. ex Sbarbaro Herb. at Farlow Herb.

PARMELIA (XANTHOPARMELIA) MOZAMBICA Vainio, Bol. Soc. Broter. II. 6:145. 1929-30.

Type: Portuguese East Africa, Palma, Moçimba da Paria, *Americo Pires de Lima 454, 460, 948, 954*; Ponta Vermelha, *Pires de Lima 931, 944*, all corticole.

Thallus up to 5.5 cm. in diameter, between cream buff and dark olive buff, K yellow, becoming dirty greenish as the solution dries, peripheral lobes about 20 mm. long, 2 mm. wide, subpinnate with excised sinuses, ultimate lobules about 1 mm. long, about 1 mm. wide, some much narrower, tips rounded, rarely truncate; underside black, a little lighter at the margins; rhizinae covering the whole underside, dark brown, mostly short and simple; upper cortex 15 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells 5–6 μ in diameter; algal layer 20 μ thick, of very close colonies of *Trebouxia* in a nearly continuous layer, cells 7–8 μ in diameter, tending to be arranged in vertical rows between medullary hyphae; medulla K– or pale yellow, C–, KC–, about 40 μ thick, of predominantly longitudinal hyphae, moderately closely woven, heavily nubilated with hyaline granules; lower cortex 10 μ thick, of fastigiate pseudoparenchyma, cells about 3 μ in diameter, relatively thinwalled and only slightly brownish in sections; rhizinae about 25 μ in diameter, formed by the outgrowth of the hyphae of the lower cortex, but the hyphae are conglutinate and the walls thicker.

KENYA: Machakos, collector not given, no. 28, at Kew.

TANGANYIKA: *Braun 8601* ex B. L. Inst. Amani, E. African Herb.

NORTHERN RHODESIA: Abercorn, growing over orchid roots on trees, *A. A. Bullock 1395* p. p. min., International Red Locust Control Service, at Kew.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler*, at Kew.

PARMELIA (XANTHOPARMELIA) **njalensis** Dodge, sp. nov.

Type: Sierra Leone, Kori, Njala, on bark of *Funtumia africana, F. C. Deighton M5642* at Kew.

Thallus 4 cm. diametro, viridis, membranaceus, 55–60 μ crassitudine, lobis 3–4 mm. longitudine, ad 1 mm. latitudine, irregulariter dichotomis aut subpinnatis, sinibus rotundatis excisisque, lobuli ultimi 0.3 mm. longitudine, 0.5 mm. latitudine, apicibus truncatis retusisve, marginibus laevibus, superne laevis, nitidus, paucis cum isidiis papilliformibus in centro thalli; inferne niger, rhizinis nigris ramosis, 30 μ diametro tecta; cortex superior 11–12 μ crassitudine, fastigiatus, cellulis 6 μ diametro; stratum algarum 20 μ crassitudine, continuum, cellulis 6–7 μ diametro; medulla K–, C evanescenter rosea, KC–, 15–20 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, dense intertextis; cortex inferior 8 μ crassitudine, brunneus, hyphis longitudinalibus 2 μ diametro, luminibus 1 μ diametro.

Thallus about 4 cm. in diameter, between Vetiver green and tea green, membranous, only 55–60 μ thick, peripheral lobes 3–4 mm. long, up to 1 mm. wide below, irregularly dichotomously to subpinnately branched, with rounded to excised sinuses, ultimate lobules up to 0.3 mm. long and 0.5 mm. wide, tips truncate to retuse, margins smooth with rhizinae showing beyond the edge as a pseudohypothallus; upper surface smooth, shining with a very few slender, short, papilliform isidia in the center of the thallus; underside black, densely covered with branched black rhizinae about 30 μ in diameter; upper cortex 11–12 μ thick, fastigiate of about two layers of isodiametric cells 6 μ in diameter; algal layer 20 μ thick, continuous, cells 6–7 μ in diameter with an occasional cell pushing up between the cortical cells or down into the medulla; medulla K–, C evanescent pink, KC–, 15–20 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter;

lower cortex 8 μ thick, of longitudinal hyphae 2 μ in diameter, brownish, protoplasts about 1 μ in diameter, growing down to form the rhizinae.

SIERRA LEONE: Kori, Njala, on bark of *Funtumia africana, F. C. Deighton M5642* at Kew.

PARMELIA (XANTHOPARMELIA) DECARYANA Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] **36**:153. 1934.

Type: Comoro Islands, Anjouan (Johana) Island, Tsantsani, corticole, *R. Decary*, ex herb. Paris.

Thallus 6–7 cm. in diameter, deep olive buff to olive buff, K dirty yellowish green, peripheral lobes about 10 mm. long, 1.5 mm. wide, repeatedly dichotomous, not conspicuously narrower at each dichotomy, ultimately lobules 1–3 mm. long, about 1 mm. wide, tips mostly truncate or retuse, sides nearly parallel, sinuses rounded, surface smooth, subnitid; underside black in the center, shading to hazel at the ultimate lobules, minutely reticulate rugulose, rhizinae in small dense groups, varying from papillae to short, slender rhizinae, ultimate lobules nude; upper cortex 15 μ thick, of fastigiate thinwalled pseudoparenchyma, protoplasts 3 μ in diameter, outer 3 μ an amorphous gel; algal layer 30 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 6–7 μ in diameter; medulla K yellow, then orange red, becoming ferruginous as the solution dries, C–, KC similer to K reaction but paler, 95 μ thick, of predominantly longitudinal hyphae, closely woven, 3 μ in diameter, heavily nubilated with minute hyaline granules throughout; lower cortex 10–12 μ thick, deep brown, of fastigiate pseudoparenchyma, rather thicker walled than the upper cortex.

Apothecia up to 1.5 mm. in diameter (immature) cupulate, margin crenate, inrolled, exciple smooth, substipitate, disc auburn; amphithecial cortex 15 μ thick, similar in structure to the upper cortex but not covered by an amorphous layer; algal layer 30 μ thick, of discrete colonies; medulla densely woven and heavily nubilated; algal layer under the parathecium 30 μ thick, continuous; parathecium 30 μ thick, gelified, fastigiate; hypothecium 20 μ thick, of slender thinwalled, periclinal hyphae, moderately closely woven; thecium 55 μ tall; paraphyses septate, once or twice dichotomous above the asci, tips slightly clavate, nearly reaching the surface of the brownish epithecial gel; asci clavate, wall about 2 μ thick, tip somewhat thicker, protoplast mamillate, 40 $\times$ 12 μ; ascospores ellipsoid, 6 $\times$ 3 μ (immature ?).

Thomas 615 has more slender ultimate lobules and is sterile.

KENYA: Machakos, 1930 m., collector not given, no. 28, 1906 at Kew.
UGANDA: Elgon, Madangi, 3550 m., on rocks in alpine meadow, *A. S. Thomas 615*; Bugishu, Buginyanya, 2100 m., on rocks, *A. S. Thomas 466*, Sese, Towa forest on rocks in grassland, 1225 m., *A. S. Thomas 3030*; all at Kew.

PARMELIA (XANTHOPARMELIA) **Wildeae** Dodge, sp. nov.

Type: St. Helena, *Mrs. Wilde*, in herb. Hookerianum at Kew.

Thallus 12 cm. diametro aut major, olivaceo-alutaceus, lobis peripheric is tenuiter nigromarginatis, 10 mm. longitudine, ad 1 mm. latitudine, irregulariter

dichotomis, sinibus rotundais, lobulis ultimis 1 mm. longitudine, ca. 0.5 mm. latitudine, apicibus truncatis, lobis centralibus ca. 3 mm. longitudine, 0.3–0.5 mm. latitudine, imbricatissimis; soralia ad 1 mm. diametro, hemisphaerica, granulosa, superficialia, neque terminalia neque subterminaliave; inferne cinnamomeus argillaceusve, opacus, rhizinis nigro-brunneis aut nigris, brevibus; cortex superior 16 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, subsphaericis, 8 μ diametro, granulis obscure brunneis nubilatis; stratum algarum coloniis discretis, 20 μ diametro, cellulis ad 8 μ diametro; medulla K flavo-rubescens, C–, KC–, 65 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, dense contextis nubilatisque; cortex inferior 20 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis 6 μ diametro, luminibus ca. 1 μ diametro, pachydermeis, gelifactisque. Apothecia non visa.

Thallus over 12 cm. in diameter, probably much larger, olive buff, peripheral lobes 10 mm. long, up to 1 mm. wide, mostly narrower, irregularly dichotomous, sinuses rounded, ultimate lobules 1 mm. long, about 0.5 mm. wide, tips truncate; central lobes very irregularly arranged, about 3 mm. long, 0.3–0.5 mm. wide, very imbricate, all narrowly black margined; soralia up to 1 mm. in diameter, hemispheric, granular, superficial, neither terminal nor subterminal on the lobules; underside cinnamon buff to clay color, opaque, rhizinae dark brown to black, in small dense groups, short; upper cortex 16 μ thick, of fastigiate pseudoparenchyma, cells nearly spherical, 8 μ in diameter, thinwalled, very heavily nubilated by dark brown granules; algal layer of discrete colonies of *Trebouxia,* 20 μ in diameter, cells up to 8 μ in diameter; medulla K yellow then red, C–, KC–, 65 μ thick, of longitudinal hyphae 3 μ in diameter, very closely woven and so heavily nubilated that the structure is obscure in thicker sections; lower cortex 20 μ thick, of fastigiate pseudoparenchyma, hyphae 6 μ in diameter, very thickwalled and gelified, lumina about 1 μ in diameter. Apothecia absent.

ST. HELENA: *Mrs. Wilde,* in herb. Hookerianum at Kew.

PARMELIA (XANTHOPARMELIA) CONSPERSULA Nyl. in Crombie, Jour. Bot. Brit. For. **14**:19. Jan. 1876; Jour. Linn. Soc. Bot. **15**:168. July 1876.

Type: Cape of Good Hope, Table Mt., *A. E. Eaton,* saxicole, Venus Transit Exp.

Thallus at least 4 cm. in diameter, conspersa green when fresh, between deep olive buff and avellaneous (1957), center rimose areolate but cracks not reaching the lower cortex, areoles polygonal, about 1 mm. in diameter, black margined, peripheral lobes about 2 mm. wide, irregularly dichotomous below, subpinnate above, sinuses rounded, ultimate lobules 0.5–1 mm. wide, tips rounded or crenate; underside black slightly rugulose, rhizinae not dense, very short, holding the thallus closely to the stone; upper cortex 15 μ thick, fastigiate, cells thinwalled, 15 $\times$ 7.5 μ, very heavily nubilated with brownish granules; algal layer from subcontinuous to scattered discrete colonies of *Trebouxia,* 30 μ in diameter, cells 6 μ in diameter; medulla K yellow then ferruginous or reddish, C–, KC ferruginascent to reddish, 80 μ thick, of closely woven longitudinal hyphae 2.5 μ in diameter, very heavily nubilated with grayish granules, loosely woven under the ridges below;

lower cortex dark brown, 8 μ thick, of about two layers of nearly isodiametric cells, extending to the top of the lobes at the margins.

Apothecia 1.5–2.5 mm. in diameter, margins entire, slightly inflexed, exciple smooth, disc chestnut, imperforate; amphithecial cortex 40 μ thick, of gelified fastigiate pseudoparenchyma, protoplasts about 2 μ in diameter, somewhat nubilated with brownish granules; algal layer of large discrete colonies, 40 μ in diameter, with much smaller colonies between; medulla loosely woven; algal layer under the parthecium 30 μ thick, continuous; parathecium 45–50 μ thick, of small celled pseudoparenchyma, probably fastigiate, but cells somewhat irregularly arranged; hypothecium 15 μ thick, of very slender, closely woven periclinal hyphae; thecium 55 μ tall; paraphyses slender, closely septate, simple or once dichotomous above, tips slightly clavate, reaching the surface of the brownish epithecial gel; asci cylindric, about 55 $\times$ 8 μ, 8-spored, relatively thinwalled; ascospores ellipsoid, 7–8 $\times$ 6 μ, with a moderately thick epispore.

Spermatia sub-bifusiform, 5–6 $\times$ 0.6–0.7 μ, fide Nylander.

CAPE OF GOOD HOPE: without locality or collector, Herb. Hookerianum at Kew (lower left plant).

PARMELIA (XANTHOPARMELIA) LEONORA Sprengel in Mass., Mem. I. R. Ist. Veneto Sci. Lett. Arti **10**:51. 1861.

Parmelia leonora v. *platyphylla* Sprengel in Fw., Linnaea **17**:29. 1843, nom. nud.
Parmelia conspersa v. *Leonora* Lindsay, Trans. R. Soc. Edinburgh **22**:233. 1859, nom. nud.

Type: Cape of Good Hope, *Drège 64*, Wawra also cited by Massalongo.

Thallus at least 7 cm. in diameter, tawny olive to clay color, shining, lobes irregularly dichotomous, 1–3 mm. wide, some internodes long and branches resemble a stag horn, other internodes short and tips with 4–6 digitate lobules, sinuses rounded, not excised, some margins microphylline, surface smooth, transversely rimose toward the bases of the lobes, eciliate; underside Brussels brown or darker, shining, minutely rugose; rhizinae stout in small groups with a terminal whorl of short branches forming the holdfasts; upper cortex 60 μ thick, of fastigiate pseudoparenchyma, cells thinwalled, 10 μ in diameter, 20 μ long, somewhat shorter next the outer surface, heavily nubilated with brownish granules in the upper 20 μ; algal layer 35 μ thick, continuous, cells 7–8 μ in diameter between vertical medullary hyphae but not filamentous; medulla K yellow, C–, KC–, 115 μ thick, of longitudinal hyphae heavily nubilated with grayish granules except in the lower 15 μ; lower cortex black, 15 μ thick, inner cells spherical 10 μ in diameter, outer cells 4 μ in diameter, thickwalled, irregularly arranged.

Apothecia subpedicellate, up to 5 mm. in diameter, urceolate, margins crenulate, inrolled, exciple smooth shining to rugulose, disc burnt sienna to chestnut, remaining concave; amphithecial cortex 50–60 μ thick, fastigiate, gelified of very thickwalled hyphae; algal layer 50 μ thick, continuous, cells closely packed; medulla loosely woven; algal layer under the parathecium 30 μ thick, cells closely packed; parathecium 50 μ thick, of fastigiate pseudoparenchyma, hyphae somewhat dichotomous above, very thickwalled, gelified; hypothecium 20 μ thick, of closely woven, slender, periclinal hyphae, deeply staining; thecium 55 μ tall; paraphyses

slender, tips clavate, ending about 5 μ below the surface of the brownish epithecial gel; asci clavate, 30 $\times$ 10 μ, walls thin, tips thickened, 8-spored; ascospores ellipsoid, falsely bilocular, ellipsoid, 7 $\times$ 3 μ.

On the same sheet is glued another plant, more greenish yellow of similar habit, but lobes much narrower, not studied microscopically.

CAPE OF GOOD HOPE: without locality, *Breutel* ex hb. R. B. van den Bosch in Tuckerman Herb. at Farlow Herb.

PARMELIA (XANTHOPARMELIA) **Wightii** Dodge, **sp. nov.**

Type: Mauritius, saxicole ?, *Robert Wight,* in Taylor Herb. sub *P. conspersa* at Farlow Herb.

Thallus plus quam 6 cm. diametro flavidus, nigricans, lobis imbricatis, ad 2 mm. latitudine, irregulariter dichotomis, sinibus rotundatis, lobulis ultimis ca. 1 $\times$ 0.5 mm., laevibus, anguste nigromarginatis; inferne niger, subrugulosus, sparsim verrucosus, rhizinis raris nigris, ca. 0.5 mm. longitudine; cortex superior 40 μ crassitudine, fastigiatus, cellulis 6 μ diametro; stratum algarum 30 μ crassitudine, coloniis discretis *Trebouxiae,* cellulis 6–7 μ diametro; medulla K–, C–, KC–, 65–100 μ crassitudine, hyphis longitudinalibus laxe intertextis; cortex inferior niger, 13–16 μ crassitudine, cellulis 6 μ diametro.

Apothecia 1–2.5 mm. diametro, margine crenulato, excipulo subimpresso, disco subconcavo planove, castaneo; cortex amphithecialis 35–40 μ crassitudine, fastigiatus; stratum algarum 20 μ crassitudine, subcontinuum; medulla arachnoidea, hyphis granulis griseis nubilatis; stratum algarum sub parathecio 45 μ crassitudine, continuum; parathecium 25 μ crassitudine, pseudoparenchymatice fastigiatum; hypothecium 10 μ crassitudine, hyphis tenuibus periclinalibus laxe intertextis; thecium 50 μ altitudine; paraphyses tenues, semel dichotomae sub apicibus incrassatis; asci late clavati 22 $\times$ 13 μ, pachydermei, apicibus incrassatis; ascosporae octonae, ellipsoideae, 6.5–7 $\times$ 3.25–3.5 μ, false biloculares.

Thallus more than 6 cm. in diameter, probably much larger, reed yellow on a few more or less sheltered lobes, mostly blackened (appearing to be a Melaenoparmelia at first sight), lobes very imbricate, the peripheral lobes very variable in outline, 2 mm. or less wide, irregularly dichotomous, sinuses rounded, ultimate lobules about 1 mm. long, 0.5 mm. wide, smooth, very narrowly black margined; underside black, very slightly rugose and sparsely verrucose, rhizinae very rare, black, about 0.5 mm. long (most of the thallus glued tightly to the herbarium sheet); upper cortex 40 μ thick, outer 10 μ fastigiate, heavily nubilated with greenish brown granules, the rest hyaline, irregularly fastigiate of thinwalled pseudoparenchyma, the cells about 6 μ in diameter; algal layer 30 μ thick, of close discrete colonies of *Trebouxia,* cells 6–7 μ in diameter; medulla K–, C–, KC–, 65–100 μ thick, of loosely woven predominantly longitudinal hyphae; lower cortex black, 13–16 μ thick, of two layers of large celled pseudoparenchyma, cells about 6 μ in diameter, the outer layer black, the inner layer brown.

Apothecia abundant, 1–2.5 mm. in diameter, margin crenulate, exciple slightly

impressed, disc subconcave to plane, chestnut; amphithecial cortex 35–40 μ thick, of the same structure as the thalline cortex; algal layer 20 μ thick, nearly continuous; medulla arachnoid, (tearing badly on sectioning), hyphae heavily nubilated with grayish granules; algal layer under the parathecium 45 μ thick, continuous; parathecium 25 μ thick, of fastigiate very thickwalled pseudoparenchyma, the upper half more deeply staining; hypothecium 10 μ thick, of very loosely woven slender periclinal hyphae; thecium 50 μ tall; paraphyses slender, septate, once dichotomous below the very slightly enlarged tip, reaching the surface of the epithecial gel; asci broadly clavate, 22 $\times$ 13 μ, wall 2 μ thick, tip 4 μ, with truncate protoplast, 8-spored; ascospores ellipsoid, falsely bilocular, 6.5–7 $\times$ 3.25–3.5 μ.

MAURITIUS: probably saxicole, *Robert Wight* in Taylor Herb. sub *P. conspersa* at Farlow Herb., type; herb Hookerianum without collector at Kew; Ponce Range, saxicole, *P. B. Ayres* at Kew; Round Island, hill 290 m., saxicole, *Henry Halero Johnson 27, 29,* at Kew.

PARMELIA (XANTHOPARMELIA) **benguellensis** (Vainio) Dodge, comb. nov.

Parmelia subconspersa v. *benguellensis* Vainio, Cat. Welwitsch African Pl. 2:401. 1901.

Type: Angola, Benguela, Huilo, 1225–1775 m., Mt. Morro de Lopollo, *Welwitsch 31* p. p.; Serra de Chella, *Welwitsch 30,* both corticole.

Thallus deep olive buff, lobes 6–7 $\times$ 1.5–2 mm., dichotomous with short internodes, appearing subpinnate, sinuses rounded to slightly excised, tips rounded to retuse; underside black to the margin, shining, very minutely rugulose, sparingly rhizinose, rhizinae several times dichotomous near the base, up to 1.5 mm. long; upper cortex 15 μ thick, fastigiate, hyphae 5–6 μ in diameter, very thickwalled, outer half nubilated with brownish granules; algal layer 15 μ thick, continuous or partly of discrete colonies 15 μ in diameter, cells 6 μ in diameter; medulla K–, C–, KC–, 30–35 μ thick, of thickwalled longitudinal hyphae, 3 μ in diameter, moderately closely interwoven, with an occasional air space under the algal layer and quite compact below; lower cortex black, 15–18 μ thick, of conglutinate, closely septate, longitudinal, relatively thinwalled hyphae 5–6 μ in diameter.

Apothecia short stipitate, superficial, about 2 mm. in diameter, margin crenate, splitting into about 5 sectors, exciple smooth, disc auburn; amphithecial cortex 23–26 μ thick, similar to the thalline cortex but nubilated only in the outer 9 μ; algal layer 25 μ thick, of close but discrete colonies; algal layer under the parathecium similar but a little thinner; parathecium 30–35 μ thick, similar to the thalline cortex but the outer cells somewhat larger with spherical protoplasts; hypothecium 7–10 μ thick, of periclinal, very slender hyphae, tending to tear away from the parathecium; thecium 45 μ tall; paraphyses slender, often once dichotomous above the asci, tips slightly clavate ending in the brownish epithecial gel, 10 μ thick asci 8-spored, cylindric clavate, 33 $\times$ 11 μ, thickwalled with thickened tips; ascospores subdistichous, thickwalled, short ellipsoidal, 7 $\times$ 5 μ.

FERNANDO PO: Santa Isabel Peak, 2575 m., corticole, *Gustavo Mann,* herb. W. A. Leighton at Kew.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler,* corticole, at Kew.

PARMELIA (XANTHOPARMELIA) GLAUCOPIS (Müll. Arg.) Vainio, Mém. Herb. Boissier 5:4. 1900.

Parmelia caperata v. *glaucopsis* Müll. Arg., Bot. Jahrb. [Engler] 20:258. 1894.

Type: Tanganyika: Usambara, Matangiri, Mgogo, corticole, *Stuhlmann 359.*

Thallus at least 4 cm. in diameter, between light grape green and tea green, peripheral lobes 10 mm. long, 1.5–2 mm. wide, irregularly dichotomous, contiguous, narrowly black margined, about 1.5 mm. wide at the fork, expanding to 2–3 mm. wide at the next dichotomy, surface low verrucose, tips rounded, central lobes very imbricate and lobulose; underside black, densely short rhizinose, rhizinae ending in circular holdfasts about 0.3 mm. in diameter, attaching the thallus very closely to the bark; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 4 μ in diameter, very heavily nubilated with brownish granules; algal layer 30 μ thick, nearly continuous, cells closely packed, 6–8 μ in diameter; medulla K yellow, C–, KC faint yellow, 103–135 μ thick, hyphae very densely woven in the thinner areas, looser in the thicker areas, about 6 μ in diameter with very thin lumina, very heavily nubilated with grayish granules; lower cortex black, about 40 μ thick, of fastigiate pseudoparenchyma, cells about 6 μ in diameter.

Apothecia up to 2 mm. in diameter, margin thick, incurved, exciple radially sulcate, subverrucose, disc concave to finally nearly plane, chalky pruinose when young, the pruina more or less weathering away when old; amphithecial cortex 20 μ thick at the margin, expanding to 40 μ thick below, of fastigiate pseudoparenchyma, heavily nubilated with brownish granules; algal layer 20 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer; medulla dense, heavily nubilated with grayish granules; algal layer under the parathecium 20 μ thick, cells closely packed in a continuous layer; parathecium 55 μ thick, of fastigiate pseudoparenchyma, extending beyond the amphithecial cortex to the top of the thecium; hypothecium 15 μ thick, of slender, thinwalled deeply staining, periclinal hyphae; thecium about 60 μ tall; paraphyses slender, closely septate, twice or thrice dichotomous above the asci, tips clavate, about 4 μ in diameter, nearly reaching the surface of the dark brown epithecial gel; asci clavate, 60 $\times$ 11 μ, tip thickened, protoplast short mamillate when young; ascospores ellipsoid, 10–12 $\times$ 8 μ, with a moderately thick epispore.

TANGANYIKA?: (E. Tropical Africa between 2° and 7° S.), corticole, *J. Hannington* det. *P. caperata* v. *caperatula* Nyl. by Müller Argau, probably before he described *P. caperata* v. *glaucopis.*

PARMELIA (XANTHOPARMELIA) HYPOLEIODES Vainio, Ann. Univ. Aboensis A 2:3:1. 1926.

Type: South Africa, near Paarl, saxicole, *Miss van Velden,* com. P. A. van der Bijl 334.

Thallus about 5 cm. in diameter, pale olive buff at the margins, darker in the center; center areolate diffract, many areoles narrowly black margined, but no hypothallus developed; marginal lobes 3–6 mm. long, 1–3 mm. wide below, once or twice dichotomous, sinuses acute or rounded, ultimate lobules 1–1.5 mm. wide, 1–2 mm. long, tips truncate or nearly so, narrowly brown margined, surface

smooth, slightly convex, closely adherent to the rock, not even the ultimate lobules free; underside black, rhizinae very short 0.3 mm. long, dense, with large holdfasts; upper cortex 12 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells about 2 μ in diameter, heavily nubilated with brownish granules; algal layer of close, discrete colonies of *Trebouxia*, 20–25 μ in diameter, forming an almost continuous layer, cells 6–7 μ in diameter; medulla K– or yellow, C–, KC yellow then red, 50 μ thick, the upper half loosely woven of vertical hyphae, the lower half of closely woven longitudinal hyphae 3 μ in diameter; lower cortex black, a single layer of isodiametric cells, very thickwalled 5–6 μ in diameter extending up the side and over the upper surface for 130 μ; rhizinae 70 μ in diameter.

CAPE OF GOOD HOPE: Cape Prov., Paarl District, on quartz pebble, com. *P. A. van der Bijl 99* ex G. K. Merrill Herb. at Farlow Herb.

PARMELIA (XANTHOPARMELIA) SYNESTIA Stirton, Trans. Glasgow Soc. Field Nat. 5:214. 1877.

Type: S. Africa, Cave Mt., on mossy stones, *J. H. McLea.*

Thallus about 8 cm. in diameter, citrine drab to olive buff, lobes 1–3 mm. wide, 20–30 mm. long, irregularly dichotomous and subpinnate, tips slightly rounded, truncate or retuse, sinuses rounded, surface smooth at first becoming minutely reticulate rimulose in the older portions; underside black, densely rhizinose in contact with the moss, rhizinae slender, unbranched, otherwise black papillate, with ultimate lobes often smooth and shining; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 4–5 μ in diameter, very heavily nubilated in the outer half; algal layer 15 μ thick, continuous, cells 6–7 μ in diameter; medulla K yellow then red, C–, KC yellow then red, white becoming deep orange red in moribund portions, 150 μ thick, of very densely woven slender hyphae, somewhat less so just under the algal layer and next the lower cortex; lower cortex black, 30 μ thick, of thickwalled fastigiate pseudoparenchyma growing out to form the rhizinae 80 μ in diameter.

Apothecia 3 (–12) mm. in diameter, substipitate, margin inflexed, entire to minutely crenulate, exciple smooth, subnitid, disc concave, amber brown; amphithecial cortex 40 μ thick, of fastigiate pseudoparenchyma, hyphae 6 μ in diameter, only slightly nubilated with brownish granules; algal layer of colonies 30 μ in diameter, close and nearly continuous; medulla loosely woven, somewhat nubilated with grayish granules next the algal layers; algal layer under the parathecium 40 μ thick, continuous, cells closely packed above, more scattered below; parathecium 45 μ thick, of fastigiate pseudoparenchyma, protoplasts about 3 μ in diameter; hypothecium 30 μ thick, of moderately closely woven thinwalled periclinal hyphae 2 μ in diameter; thecium 45 μ tall; paraphyses septate, once dichotomous above the asci, branches moniliform, tips slightly clavate, ending 8–10 μ below the surface of the very pale brownish epithecial gel; asci cylindric clavate, about 30 $\times$ 8 μ, 8-spored, tips thickened when young; ascospores ellipsoid, 7–10 $\times$ 5.5–6.5 μ, with a moderately thick epispore.

Thomas 626 has narrower, more irregular lobes, approaching those of *P. Benyovskyana* Gyelnik in size, but distinctly flattened, and larger apothecia, up to 12 mm. in diameter, but it agrees with *P. synestia* Stirton microscopically.

CAPE OF GOOD HOPE: without locality or collector, Herb. Hookerianum at Kew; Transvaal, near Lydenburg, saxicole, *F. Wilms 2753*, at Kew.

TANGANYIKA: Kilimandjaro, muscicole, *R. G. Turrall 70a*, ex E. African Agr. Res. Sta. Amani, at Kew.

UGANDA: Mt. Elgon, Masaba, 4550 m., on stones in alpine meadow, *A. S. Thomas 626*, at Kew.

PARMELIA (XANTHOPARMELIA) stenotera (Stirton) Dodge, comb. nov.

Parmelia phaeophana v. *stenotera* Stirton, Trans. Glasgow Soc. Field Nat. **5**:215. 1877. for further description of type, see Gyelnik, Ann. Mus. Nat. Hungar. Bot. **31**:36. 1938.

Type: Cape of Good Hope, Somerset East, terricole, *P. MacOwan.*

Thallus covering areas at least 17 × 12 cm., lobes so irregularly arranged and imbricate that it is difficult to make out individual thalli, pale Veronese green, primary lobes 10–20 mm. in diameter nearly circular, margins sinuate, crenate or dentate, some growing out as irregularly dichotomous secondary lobes about 2–3 mm. wide, of variable lengths, the ultimate lobules about 0.5 mm. wide, sometimes appearing digitate when the upper internodes are very short; underside black, sometimes clay color on the lobules, shining; rhizinae very dense throughout, short, black, 0.2–0.3 mm. long, branched at the tips; upper cortex 25 μ thick, fastigiate from dichotomous hyphae arising from medullary hyphae passing up through the algal layer, protoplasts about 2 μ in diameter, the outermost 6 μ decomposed into an amorphous hyaline gel, not nubilated; algal layer 45 μ thick, continuous above, cells more widely spaced below, 6 μ in diameter; medulla K yellow then red, C–, KC yellow then red, 135 μ thick, white becoming orange red where moribund, of predominantly longitudinal hyphae 2 μ in diameter, thinwalled, moderately closely woven above, very loosely so in the lower third; lower cortex black, 15 μ thick, subfastigiate, imbedded in a deep brown gel.

Apothecia 6–7 mm. in diameter, sessile on primary lobes and nearly covered by secondary lobes of adjacent thalli, margin thin, minutely crenulate, exciple irregularly concentrically rugulose, disc plane, imperforate, burnt sienna or darker; amphithecial cortex 25 μ thick, fastigiate, hyphae 3 μ in diameter, protoplasts isodiametric, about 1 μ in diameter, very heavily nubilated with brownish granules; algal layer partly continuous, 40 μ thick, partly of widely spaced discrete colonies, 30–40 μ in diameter, with lacunae between as if the algae had died and disintegrated; medulla very thick, arachnoid in the outer half, somewhat more closely woven next the algal layer below the parathecium which is 30–40 μ thick, continuous; parathecium 30 μ thick, of fastigiate pseudoparenchyma; hypothecium 30 μ thick, of slender, thinwalled deeply staining periclinal hyphae; thecium 45 μ tall; paraphyses slender, branching above the asci, branches submoniliform, tips not or very slightly thickened, ending about 5 μ below the surface of the brownish epithecial gel; asci cylindric, 8-spored, about 30 × 8 μ, tip thickened when young; ascospores 8–10 × 6–7 μ, with a thin epispore.

TANGANYIKA: Kilimanjaro, 4610 m., *H. H. Johnston 21* det. *P. conspera* v. *laxa* Müll. Arg. by Müller Argau at Kew; Bismarck-Peters, 3570 m., on volcanic rock in alpine meadows above temperate rain-forest, *R. G. Turrall 70* at Kew.

PARMELIA (XANTHOPARMELIA) **Zenkeri** Dodge, sp. nov.

Type: Cameroun, Bipinde, in primaeval forest, corticole, *G. Zenker 4053*, in Dodge Herb. and at Kew.

Thallus 10–12 cm. diametro, olivaceous brunnescens; lobis latitudine variabilibus, lobulis ultimis 4–7 × 2–3 mm.; inferne pallide brunneo-olivaceus, rugosus, rhizinis albidis, densis; cortex superior 25 μ crassitudine, fastigiatus, gelifactus, luminibus 1 μ diametro; stratum algarum ad 30 μ crassitudine, partim coloniis discretis *Trebouxiae*, partim continuum; medulla alba, K–, C–, KC–, 200 μ crassitudine, subarachnoidea, hyphis pachydermeis, 3 μ diametro; cortex inferior 16–17 μ crassitudine, fastigiatus, gelifactus, dimidia parte externa amorphus.

Apothecia sessilia, 3–4 mm. diametro, margine integro subcrenatove, disco cinnamomeo-rufo dein castaneo-brunneo; cortex amphithecialis 35 μ crassitudine; strata algarum 16–20 μ crassitudine; parathecium 35 μ crassitudine, fastigiatum, ad 50 μ crassitudine ad latera thecii; hypothecium 35 μ crassitudine, hyphis periclinalibus dense contextum; thecium 80 μ altitudine; paraphyses tenues, apicibus clavatis; asci clavati, 65 × 9 μ, apicibus non incrassatis; ascosporae ellipsoideae, 6 × 4 μ (immaturae ?).

Thallus 10–12 cm. in diameter, drying ecru olive to dark olive buff at the margins, center finally buffy brown to olive brown, lobes variable in width, ultimate lobes 5–7 × 2–3 mm., sinuses slightly or not excised; underside light brownish olive at the margin, brownish olive toward the center, rhizinae white, dense except a narrow nude margin on some lobes, not on others, branched in the outer half, tips forming a small disc holdfast in contact with the substrate, surface very rugose and subscrobiculate; upper cortex 25 μ thick, fastigiate, gelified, lumina about 1 μ in diameter; algal layer up to 30 μ thick, partly continuous, partly of discrete colonies of *Trebouxia*, 20–25 μ in diameter; medulla white, K–, C–, KC–, 200 μ thick, hyphae thickwalled, 3 μ in diameter, very loosely woven to almost arachnoid, more closely woven under the algal layer; lower cortex 16–17 μ thick, fastigiate, gelified, the outer half amorphous.

Apothecia sessile, 3–4 mm. in diameter, margin entire to slightly crenate, disc cinnamon rufous to hazel, finally chestnut brown; amphithecial cortex 35 μ thick, fastigiate, gelified, lumina 1 μ in diameter; algal layer 16–20 μ thick both next the cortex and under the parathecium; parathecium 35 μ thick below the hypothecium, expanding to 50 μ thick at the top of the thecium, of conglutinate, thick-walled fastigiate hyphae; hypothecium 35 μ thick, of closely woven, periclinal hyphae; thecium 80 μ tall; paraphyses slender, terminal cell clavate ending 7–8 μ below the surface of the brownish epithecial gel; asci stipitate clavate, 8-spored, 65 × 9 μ, stipe 40 μ long, tip not conspicuously thickened; ascospores short ellipsoid, about 6 × 4 μ, still in the ascus and probably immature.

CAMEROUN: Bipinde, in primaeval forest, corticole, *G. Zenker 4053*, type, in Dodge Herb. and at Kew.

PARMELIA (XANTHOPARMELIA) **Eylesii** Dodge, sp. nov.

Type: Southern Rhodesia, Makoni District, Forest Hill Kop, in kloof, south aspect, little sun, on rock, 1595 m., *Frederick Eyles 832*, at Kew.

Thallus griseo-viridis, siccitate olivaceo-alutaceus, laevis, lobis ad 20 × 3–5 mm., dichotomis, sinibus subexcisis, apicibus retusis; inferne cinnamomeo-alutaceus, reticulatim rugosus, subscrobiculatusve, rhizinis nigris, brevibus, simplicibus; cortex superior, 20–25 μ crassitudine, pseudoparenchymatice fastigiatus, protoplastis sphaericis, 4 μ diametro, strato amorpho ad 7 μ crassitudine tectus; stratum algarum ca. 35 μ crassitudine, coloniis sphaericis discretis *Trebouxiae,* cellulis 9–10 μ diametro; medulla K–, C–, KC–, 200 μ crassitudine, strato superiore 65 μ crassitudine compacto, granulis albidis nubilato, strato inferiore hyphis lepto-dermeis longitudinalibus, 6 μ diametro; cortex inferior 30 μ crassitudine, fastigiatus, gelifactus, brunneus.

Apothecia submarginalia, ad 6 mm. diametro, subpedicellata, margine integro dein crenato, excipulo laevi, disco castaneo; cortex amphithecialis superne 10 μ, inferne 40 μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 35 μ crassitudine, evanescens; stratum algarum sub parathecio 16–23 μ crassitudine, coloniis discretis; parathecium 25 μ crassitudine, hyphis periclinalibus; hypothecium 10 μ crassitudine, hyphis tenuibus intertextis; thecium 60 μ altitudine; paraphyses tenues, simplices, apicibus non incrassatis; asci anguste clavati, 35 × 7 μ; ascosporae ellipsoideae, monostichae, subimbricatae, 7 × 5 μ.

Thallus gray green when fresh, drying olive buff shading to deep olive buff at the center, smooth, lobes up to 20 × 3–6 mm., dichotomous, sinuses somewhat excised, tips retuse; underside cinnamon buff, reticulately rugose and subscrobiculate; rhizinae very few, short, simple, nearly black, mostly torn away in removing the thallus from the rock; upper cortex 20–25 μ thick, of fastigiate pseudoparenchyma, moderately thickwalled, protoplasts spherical 4 μ in diameter, upper 7 μ heavily nubilated with brownish granules, in places overlaid with a hyaline amorphous layer 7 μ thick; algal layer about 35 μ thick, of discrete spherical colonies of *Trebouxia,* cells spherical 9–10 μ in diameter, sometimes in vertical rows between medullary hyphae but clearly not filamentous; medulla K–, C–, KC–, 200 μ thick, the upper 65 μ very compact and heavily nubilated with white granules, the rest of mostly longitudinal hyphae 6 μ in diameter, relatively thinwalled, interlaced with transverse hyphae; lower cortex about 30 μ thick, the outer 10 μ brown, fastigiate, highly gelified.

Apothecia submarginal, up to 6 mm. in diameter, subpedicellate, margin entire at first, then coarsely crenate, exciple smooth, disc chestnut; amphithecial cortex 40 μ thick below narrowing to 10 μ at the top of the thecium, of fastigiate pseudoparenchyma, moderately thickwalled; algal layer of discrete spherical colonies, disappearing below where the cortex is completely hyaline; algal layer under the parathecium only 16–23 μ thick, colonies more widely separated; parathecium 25 μ thick, of three layers, the upper and lower layers of gelified periclinal hyphae, the middle layer of thinwalled periclinal pseudoparenchyma and more deeply staining; hypothecium 10 μ thick, of very slender interwoven hyphae; thecium 60 μ tall; paraphyses slender, unbranched, tips not thickened, ending at the base of the brownish epithecial gel, 10 μ thick; asci narrowly clavate, 35 × 7 μ; ascospores short ellipsoidal, monostichous, subimbricate, 7 × 5 μ.

SOUTH AFRICA: Natal, Van Reenen, 1775 m., on stones, *M. Franks* com. I. M. Wood 12273, at Kew; Kentani District on exposed stones along streams, *Alice Pegler 1229*, at Kew.

SOUTHERN RHODESIA: Makoni District, 1550 m., on dead wood, *Frederick Eyles 822*; Forest Hill Kop, in kloof, south aspect, little sun, on rock, 1595 m., *Frederick Eyles 832*, type; both at Kew.

PARMELIA (XANTHOPARMELIA) CONCOLOR Sprengel, Syst. Veg. 4:2:328. 1827.

Type: Cape of Good Hope.

Thallus fragmentary, clay color to cinnamon buff, some central lobes rounded, 9 mm. wide, margin thick, sulcate, entire to slightly and coarsely dentate, recurved, surface very rugose and bullate, the bullae with immersed spermogonia (resembling the pseudostromata of *Pertusaria*), with apothecia along the folds; underside isabella color, lighter toward the margin; rhizinae isabella color, dense, very short, forming minute disc holdfasts with fimbricate margins; upper cortex 30 μ thick, the outer half completely gelified, amorphous, hyaline, the inner half of fastigiate pseudoparenchyma, cells cylindric, 10 $\times$ 6 μ, heavily nubilated with greenish brown granules; algal layer 40 μ thick, of solitary cells 7–10 μ in diameter and small colonies of *Trebouxia* in a nearly continuous layer; medulla K–, C–, KC–, 225 μ thick, of intricately, moderately closely woven, thickwalled hyphae 5–7 μ in diameter, predominantly longitudinal, more loosely woven below, heavily nubilated in the upper 100 μ; lower cortex 10 μ thick, of a single layer of very thickwalled pale yellowish hyphae, protoplasts spherical, 2.5 μ in diameter; rhizinae 60–65 μ in diameter, formed by the downgrowth of medullary hyphae, corticate with cells from the lower cortex.

Apothecia abundant, 5 mm. in diameter, margin thick, incurved, crenate, exciple smooth, disc concave to plane, Brussels brown; amphithecial cortex 42–50 μ thick, fastigiate, gelified, (judging by the stained protoplasts, hyphae about twice dichotomously branched, the branches curving upward and soon parallel); algae disappearing under the amphithecial cortex, the very loosely woven medullary hyphae in contact with the cortex, slightly nubilated with grayish granules; algal layer under the parathecium up to 65 μ thick, of scattered cells and small colonies in a more or less continuous layer; parathecium 15 μ thick, of gelified, fastigiate pseudoparenchyma from dichotomy of medullary hyphae above the algal layer, deeply staining protoplasts about 2 μ in diameter; hypothecium 13 μ thick, of slender, closely woven, periclinal hyphae; thecium 50 μ tall; paraphyses slender, once dichotomous above, tips slightly clavate, ending near the surface of the brownish epithecial gel; asci clavate, 8-spored, about 40 $\times$ 13 μ, wall thin, tips thickened, ascospores subspherical, 6–7 $\times$ 5–6 μ.

CAPE OF GOOD HOPE: forests toward Grahamtown, corticole ?, *Zeyher 1* in Taylor Herb. sub *P. rugosa* Tayl., det. *P. conspersa* by Tuckerman, Farlow Herb.

PARMELIA (XANTHOPARMELIA) PHAEOPHANA Stirton, Trans. Glasgow Soc. Field Nat. 5:215. 1877.

Type: South Africa, Cape Province, Somerset East, terricole, *P. MacOwan*.

Thallus covering areas at least 9 $\times$ 5 cm., probably larger, very imbricate, center olive buff or darker, shading to olive buff on the marginal lobes, central lobes

up to 15 mm. long, 7–8 mm. wide, margins dentate to lobulate, lobules 2 mm. long, 1 mm. wide, tips rounded to truncate, very irregularly dichotomous with rounded sinuses, peripheral lobes similar but smaller and more irregular, narrowly black margined in the distal portions, surface subnitid, minutely white punctate or reticulate; underside tawny in the center, darker to Mars brown or almost black at the margins, subnitid, sparsely verrucose to papillate, a few papillae growing out as short concolorous rhizinae ending in a minute disciform holdfast; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter, very heavily nubilated with brown granules; algal layer 30 (–40) μ thick, continuous or nearly so, cells 6μ in diameter; medulla K yellow, slowly red, C–, KC yellow, slowly red, 95–105 μ thick, of very densely woven thickwalled hyphae 4 μ in diameter, heavily nubilated throughout with grayish granules; lower cortex light brown in section, about 11 μ thick, of fastigiate pseudoparenchyma, protoplasts about 1 μ in diameter.

Apothecia 5–7 (–11) mm. in diameter on the central lobes, quite abundant, margins inflexed, crenate to crenulate, exciple smooth, disc bay or darker, imperforate, remaining concave; amphithecial cortex 15 μ thick, of fastigiate pseudoparenchyma, very heavily nubilated with brownish granules; algal layer 50 μ thick, continuous, cells up to 12 μ in diameter; medulla arachnoid; algal layer under the parathecium 40 μ thick, continuous, cells mostly 6–8 μ in diameter; parathecium 30 μ thick, of fastigiate pseudoparenchyma, protoplasts 2.5 μ in diameter, very deeply staining; hypothecium 25 μ thick, of slender, thinwalled periclinal hyphae; thecium 55 μ tall; paraphyses simple or dichotomous above the asci, tips not thickened, ending about 8 μ below the surface of the yellowish epithecial gel; asci cylindric, 8-spored, about 40 $\times$ 8 μ, with thick walls and thicker tips when young; ascospores short ellipsoidal, 6–7 $\times$ 5–5.5 μ (perhaps immature, not seen free from the ascus), with a thick epispore. Stirton records the ascospores as 8–10 $\times$ 5–6 μ in the original description.

NATAL: Drakenberg, *Fielden*, det. *P. conspersa* v. *hypoclystoides* Müll. Arg. by Müller Argau, at Kew.

CAPE OF GOOD HOPE: Simon's Bay, Table Mt., north oak forest, over hepatics on stones, [*Breutel ?**] *282*, Dec. 1852, det. *P. conspersa* v. *hypoclysta* Nyl. by Müller Argau, at Kew.

Sect. Hypotrachyna

Parmelia sect. *Hypotrachya* Vainio, Etude Lich. Brésil 1:58. 1890.
Parmelia subg. *Euparmelia* sect. *Hypotrachyna* Zahlbr. in Engler & Prantl, Nat. Pflanzenfam. I. 1*:212. 1907.

Type: *P. acanthifolia* Pers.

Thallus glaucous to gray, appressed or with the tips of the lobes ascendant, lobes varying from narrow, linear to broader and rounded; underside usually black, sometimes pale, rhizinose to the margin or the submarginal rhizinae reduced to dark papillae or verrucae, rarely absent in the outer 1–2 mm.; medulla white (except stramineous in *P. madagascarensis*); apothecia sessile or substipitate, disc usually imperforate, rarely perforate; parathecium of fastigiate hyphae or pseudo-

* The only other collector I know of who may have been in this region at the time was Charles Wright, botanist of the U. S. North Pacific Exploring Expedition. In Tuckerman's publications of his lichens, I do not find any species of *Parmelia* sect. *Xanthoparmelia* listed, nor did I find a duplicate of this specimen in Tuckerman's herbarium at the Farlow Herb.

parenchyma (except in *P. insignata* with thickwalled periclinal hyphae); asci usually thinwalled with tips thickened when young, a few species having walls up to 2 μ thick (up to 3 μ in *P. decorata* and *P. ornata*); ascospores small to medium (up to 18 μ long, but over 22 μ long in *P. Menziesii, P. pachysperma* and *P. Schweinfurthii*). Spermogonia of the usual type, immersed in the thallus, not in bullate prominences.

The problem of separation of species of sect. *Hypotrachyna* from *Xanthoparmelia* has been discussed on p. 52. Ordinarily separation from subg. *Amphigymnia* is no problem on account of the coarser, less dense rhizinae confined to the central portion of the thallus with broad nude zones at the margins of the lobes in the latter. In a few species of sect. *Hypotrachyna,* the margins are nude of rhizinae in a narrow zone up to 2 mm. wide and small marginal lobules may be wholly nude, while in subg. *Amphigymnia,* the nude zone at the margin is always 3 mm. wide, usually much wider.

1. Thallus isidiose, sometimes also sorediose (if only exciple isidiose see *P. Hanningtoniana* Müll. Arg. and *P. hypocraea* Vainio, no. 21 and no. 24 respectively in this key).....2
1. Thallus sorediose or pseudocyphellate but not isidiose.....11
1. Thallus margins microphylline, habit of *Lecanora* subg. *Squamaria* or a small *Physcia*; lobes 1 mm. wide, irregularly subpinnatifid, very convex, pulverulent at first; apothecia 1 mm. in diameter, disc fuscous, concave, ascospores 8–10 × 6–7 μ; South West Africa (see also *P. revoluta* v. *ambigua* no. 3 below).....*P. lecanoracea* Müll. Arg.
1. Thallus neither isidiose, sorediose or microphylline.....20
   2. Isidia confined to margins; thallus pale ochroleucous, margins black ciliate; apothecia pedicellate, urceolate, 6–10 mm. in diameter, disc pale fuscous; ascospores 22–25 × 12–15 μ, very thick walled; ramulicole; Socotra.....*P. Schweinfurthii* Müll. Arg.
   2. Isidia both marginal (minutely lobulate) and superficial; thallus pale glaucescent, rhizinae showing at the margin but not truly ciliate; medulla K–, C–; apothecia 2.5–6 mm. in diameter, disc rufous, margin entire to crenulate, without spermogonia; ascospores 14–18 × 9–12 μ; Angola.....*P. coronata* v. *denudata* Vainio
   2. Isidia superficial only.....3
3. Thallus isidio-scrobiculate, margins microphylline; habit of *P. saxatilis;* Tanganyika.....*P. revoluta* v. *ambigua* Stein
3. Isidia coralloid, at least in part.....4
3. Isidia wholly simple, mostly quite short.....6
   4. Apothecia 13–20 mm. in diameter; pale below with pale rhizinae; surface rugulose, margin incised crenate to lacerate and almost isidioid; medulla K–, C pink, KC–; truncicole; Cape of Good Hope.....*P. phricodes* (Stirton) Dodge
   4. Apothecia smaller, 2–5 (–7) mm. in diameter.....5
5. Isidia slender, partly cylindric; lobes dichotomous, 15 × 3–5 mm.; medulla K yellow then red, C pale yellow, KC–; ascospores not developed; saxicole; Guinée.....*P. laevigatoides* des Abb.
5. Isidia 0.5–1 mm. long, subarticulate; lobes probably broad; medulla K yellow rufescent, KC red; ascospores 11–16.7 × 7–9 (–10) μ; corticole; Cape of Good Hope.....*P. Junodii* Steiner
5. Isidia cylindric or branched; lobes more or less pinnate, 25 × 10 mm.; medulla K–, C–, KC–; ascospores 9–10 × 5–6 μ; saxicole; Madagascar to Réunion.....*P. meizosporoides* Dodge
   6. Isidia forming soredia or soredia also present.....7
   6. Isidia not forming soredia.....8
7. Thallus very rimulose, minutely and sparsely isidiose with chalky white soredia; corticole; Socotra.....*P. tiliacea* v. *rimulosa* Müll. Arg.
7. Thallus not rimulose, isidia small, breaking down as soredia; margins with subspheric glands, black; apothecia 1–2.5 mm. in diameter; ascospores 9–11 × 6–7 μ, thickwalled; medulla K yellow then red; corticole; Madagascar.....*P. subglandulifera* Hue
7. Thallus subreticulate rimulose, clay color, tips of lobes glaucous; soredia isidioid; apothecia 2–2.5 mm. in diameter; ascospores 8 × 5 μ; medulla K–, C–, KC–; South Africa.....*P. leptophylla* Müll. Agr.
   8. Margins eciliate.....9
   8. Margins ciliate.....10
9. Medulla K–, C–, KC very slowly yellow; apothecia 5 mm. in diameter; ascospores 10–12 × 6–7 μ; lobes 10 × 3–5 mm., subpinnate; trunicole; Angola.....*P. concrescens* Vainio
9. Medulla K yellow then orange red, C–, KC–; apothecia 2.5 mm. in diameter; ascospores 18.5 × 8 μ; ramulicole; Somaliland.....*P. Gilletti* Dodge

10. Margins microphylline, isidiose dissected, central portions more or less isidiose; medulla K–, C–, KC–; Tanganyika.....*P. subisidiosa* (Müll. Arg.) Dodge
10. Margins minutely isidiose; apothecia 2–5 mm. in diameter; ascospores 10–12 × 6–8 μ; medulla K yellow ferruginascent, C pink fading, KC–; truncicole; Angola.....*P. isidiza* Nyl.
10. Margins not microphylline nor isidiose; lobes 5 × 2–3 mm., subpinnate; sterile; medulla K–, C–, KC–; corticole; Uganda.....*P. sublaevigatoides* Dodge
11. Medulla and subapical soredia stramineous, K yellow, C–; lobes 1–3 mm. wide, axils excised; muscicole; Madagascar.....*P. madagascarensis* Vainio
11. Medulla and soredia white.....12
12. Soredia small, punctate, probably pseudocyphellae.....13
12. Soredia on upper surface only; margins eciliate.....15
12. Soredia both superficial and marginal, margins short black ciliate, ends of lobes rounded, deeply crenate, margins lobulate sorediose; medulla K–, C–, KC–; terricole; Madagascar.....*P. foliolosa* Dodge
12. Soredia marginal, apical or confluent, sometimes spreading to the adjacent surface of the marginal lobes.....18
13. Cilia 1 mm. long, 3–4-fid; lobes pinnatifid; medulla sublutescent; black below; S. Africa .....*P. pilosa* Stzbgr.
13. Thallus not truly ciliate (rhizinae from underside bend outward and extend beyond the margin in *P. subaequans*, thus imitating cilia).....14
14. Irregularly dichotomous, subpinnate toward the truncate or retuse tips; underside black; medulla K–, C–, KC– or rose; ascospores 14–15 × 9–11 μ; muscicole; Cape of Good Hope.....*P. subaequans* Nyl.
14. Habit of *P. subaequans* but pseudocyphellae not mentioned; underside pale; ascospores 12–16 × 7–9 μ; spermatia cylindric, curved, 4.5–5.5 × 0.6 μ; muscicole; S. Africa .....*P. toxodes* Stirton
14. Lobes rounded, margins sorediate, dark below with paler margins and pale rhizinae; medulla and soredia, K–, C–, KC pink; S. Africa.....*P. insignata* Stzbgr.
14. Peripheral lobes rounded, central lobes microphylline, margins not sorediose; underside yellow brown, almost white at the margins; medulla K–, C red; Réunion..... .....*P. subrudecta* f. *Rodriguesii* Hue
14. Lobes subpinnate, soredia capitate on lower lobules; underside dark; medulla K–, C red, KC–; corticole; S. Africa.....*P. Bijlii* Vainio
15. Medulla reactions unknown; soredia isidioid; thallus clay color, lobes irregular, margins crenate, tips glaucous, subreticulate rimulose; underside black; apothecia 2–2.5 mm. in diameter; ascospores 8 × 5 μ; S. Africa.....*P. leptophylla* Müll. Arg.
15. Medulla K yellow.....16
15. Medulla K– 17
16. Habit of *P. vicinior* but smaller, lobes longer; sterile; presumably K yellow, KC–, lobes rounded, crenate, black below; corticole over mosses; Kenya..... .....*P. vicinior* v. *bryophila* Cengia Sambo
16. Soredia in slender reticulate lines near tips, confluent sorediose near center; medulla K pale yellow, C–, KC orange; Tanganyika.....*P. tenuirima* v. *sorediata* Müll. Arg.
17. Thallus pale glaucous, K yellow; medulla K–, C–; Eritrea.....*P. asmarana* Vainio
17. Thallus pale ashy, lobes 15 × 3–5 (–7) mm., K yellow; axils excised; soredia often confluent forming a rugose farinose crust; black below, chestnut at the margins; medulla K–, C pink; truncicole; Côte d'Ivoire.....*P. Mangenotti* des Abb.
18. Margins ciliate, sometimes irregularly so; underside black.....19
18. Margins eciliate; soredia apical; thallus pale glaucescent; lobes dichotomous, 0.5–5 mm. wide; medulla K yellow then red; Madagascar.....*P. Majoris* Vainio
19. Apothecia 5–6 mm. in diameter, finally perforate; ascospores 9–15 × 6–8.5 μ; medulla K yellow, red in spots, C–; thallus K yellow, C–; corticole; Tanganyika....*P. usambarensis* Steiner
19. Apothecia 2–7 mm. in diameter, exciple smooth, finally slightly rugulose, margin entire or sorediose, disc imperforate; ascospores variable 14–17 × 10–12 μ or 14–15 × 8–9 μ; medulla K and KC yellow then red; thallus K yellow; Madagascar to Réunion..... .....*P. decorata* (Hue) Dodge
19. Apothecia up to 12 mm. in diameter; ascospores 9.5–14 × 6.5–9 μ; medulla K yellow, unevenly rufescent, KC–; thallus K–, C–; saxicole; Natal to Uganda.....*P. reterimulosa* Steiner
19. Apothecia 2–5 mm. in diameter, imperforate; ascospores 13–14 × 9–10 μ; exciple white reticulate then very sorediose; medulla K yellow then red, KC–; corticole; Mauritius.... .....*P. ornata* (Hue) Dodge
19. Apothecia 5–6 mm. in diameter; ascospores 11 × 6 μ; margin sorediose, exciple white reticulate and sorediose; medulla K slightly yellow; KC clear yellow, sometimes reddening; St. Helena.....*P. Sanctae-Helenae* Dodge
20. Epiphyllous, poorly described; Tanganyika.....*P. conspicua* v. *epiphylla* Cengia Sambo
20. Not epiphyllous.....21
21. Underside intense stramineo-yellow, margins with long black cilia; apothecia submarginal, 5–10 mm. in diameter, pedicellate, exciple tuberculate almost isidiose; ascospores 16–18 × 10–12 μ; Kenya or Uganda.....*P. Hanningtoniana* Müll. Arg.

21. Underside white or pale....22
21. Underside black or dark fuscous....25
21. Underside unknown; poorly described in terms of other species....35
22. Habit of *P. subaequans* but pseudocyphellae not mentioned; ascospores 12–16 × 7–9 μ medullar reactions unknown; spermatia cylindric, curved, 4.5–5 × 0.8 μ; muscicole; S. Africa....*P. toxodes* Stirton
22. Center rimose areolate; marginal lobes 15–20 × 0.5–2 (–4) mm.; apothecia 2.5 mm. in diameter; ascospores 7–10 × 4–4.5 μ; medulla K–, C red; saxicole; S. Africa....*P. perfissa* Steiner & Zahlbr.
22. Habit of *P. quercina,* i.e. lobes broader, rounded....23
23. Apothecia subpedicellate, exciple smooth; underside very rugose; S. Africa....*P. subquercina* Müll. Arg.
23. Apothecia sessile or nearly so....24
24. Medulla K–, C–, KC–; lobes semicircular, 10 mm. in diameter; apothecia 2 mm. in diameter, margin crenate, exciple smooth; ascospores 8 × 5 μ (immature ?); ramulicole; Ethiopia....*P. Lythgoeana* Dodge
24. Medulla K yellow, C–; lobes 1–5 mm. wide; muscicole; Mt. Ruwenzori....*P. leucorhiza* Vainio
24. Medulla K yellow then red, C–; lobes 1.5–5 mm. wide; apothecia 2–4 mm. in diameter, exciple isidiose; ascospores 9–12 × 6–7 μ; corticole; Angola....*P. hypocraea* Vainio
25. Ascospores over 24 μ long....26
25. Ascospores 18–19.5 × 9 μ; medulla K yellow rufescent fading to yellow, KC faint evanescent yellow; lobes pinnate with rounded sinuses; apothecia 4–5 mm. in diameter, exciple rimose areolate; Cape of Good Hope....*P. Menziesii* Dodge
25. Ascospores less than 15 μ long....27
25. Ascospore size unknown or plants sterile....33
26. Medulla K yellow then red; lobes short; apothecia 7–12 mm. in diameter; ascospores 24–34 × 12–17 μ; ramulicole; Fernando Po....*P. coilocarpa* Stirton
26. Medulla K–, KC–; lobes 10–15 mm. wide; apothecia 6–10 mm. in diameter; ascospores 28–30 × 16–17 μ, epispore 4 μ thick; Réunion....*P. pachysperma* Hue
27. Habit of *P. carporhizans,* thallus white or pale ashy; apothecia eciliate; medulla presumably C pink; ascospores 8–11 × 4–6 μ; saxicole; Cape of Good Hope....*P. atrichoides* Nyl.
27. Lobes 10 × 5 mm.; apothecia 20 mm. in diameter, stipitate, margin crenate, exciple very deeply scrobiculate; ascospores 12–13 × 6–7 μ; lignicole; S. Rhodesia....*Omphalodium mazoense* Dodge
27. Lobes 20 × 1–1.5 mm.; apothecia 6–7 mm. in diameter, margin deeply crenate, exciple radially sulcate; ascospores 10–12 (–14) × 6–7 (–8) μ; saxicole; Cape of Good Hope....*Omphalodium hypoleium* (Nyl.) Dodge
27. Lobes 4–6 mm. wide; apothecia 1.5–8 mm. in diameter, sessile, margin crenulate, exciple smooth; medulla K–, C–, KC red; saxicole; Madagascar....*P. Rodriguesiana* Hue
27. Habit of *P. laevigata,* lobes relatively long and narrow....28
27. Habit of *P. quercina,* lobes relatively short and broad....30
28. Medulla K–....29
28. Medulla K yellow, then red; lobes 2–8 mm. wide; apothecia 5 mm. in diameter, margin subcrenate, disc imperforate; ascospores 10–14 × 8–10 μ; Cape of Good Hope....*P. Owaniana* Stirton
29. Lobes 0.5–2.5 mm. wide, nearly linear, tips subtruncate, appressed; apothecia 2–7 mm., margin crenulate, disc concave, imperforate; ascospores 7–12 × 5–6 μ; Angola....*P. angloensis* (Vainio) Bijl
29. Lobes 2–6 mm. wide; apothecia 6–15 mm. in diameter, exciple pale, rugulose, disc chalky pruinose, perforate; ascospores 8–9 × 3–4 μ; Congo and Uganda....*P. ducalis* Jatta
29. Lobes imbricate, partly fuscescent; apothecia 1–3 mm. in diameter; margin subcrenulate; ascospores 8–10 × 4.5–5.5 μ; Mauritius....*P. subfuscescens* Nyl.
29. Lobes 30 × 5 mm.; apothecia up to 7 mm. in diameter, margin crenate; ascospores 7 × 5 μ; medulla KC–; Congo....*P. kahusiensis* Dodge
29. Lobes 20 × 6–7 mm.; apothecia up to 6 mm. in diameter, margin entire, disc perforate; ascospores spherical, 6 μ in diameter, thickwalled; medulla KC yellow; muscicole; Congo....*P. subplumbeata* Dodge
30. Medulla K– or very faintly yellow....31
30. Medulla K yellow, at least next the algal layer....32
30. Medulla K yellow then red, C–; lobes 4–7 × 2–5 mm.; apothecia 2–3 mm. in diameter; ascospores 7–11 × 5–7 μ; Kenya....*P. sensibilis* Steiner & Zahlbr.
31. Lobes 1–2.5 × 0.1–1.2 mm.; apothecia 0.75–1 (–1.5) mm. in diameter; ascospores 6.5–10 × 4.5–5.5 μ; medulla C and KC pink above; Transvaal....*P. brachyphylla* Müll. Arg.
31. Lobes 20 × 3–4 mm.; apothecia 1–1.5 mm. in diameter (immature ?); ascospores 7–8 × 5–5.5 μ; medulla C and KC–; corticole; Angola....*P. ganguellensis* Dodge
31. Lobes 3 × 2 mm.; apothecia 3 mm. in diameter; ascospores 10–13 × 5–6 μ; medulla K very faint yellow, C–, KC–; ramulicole; Sierra Leone....*P. Deightoni* Dodge

32. Lobes 30 × 3–4 mm.; apothecia 2.5–3 (–4) mm. in diameter, margin entire to subcrenulate, sessile, disc rufous; ascospores 8 × 5.5 μ; medulla K yellow next the algal layer, rest negative, C–, KC–; Mt. Ruwenzori.....*P. Scottii* Vainio
32. Lobes 3.5 × 3.5 mm.; apothecia 4–6 (–14) mm. in diameter; ascospores 7–13 × 5–7.5 μ; medulla K wholly yellow, C–, KC yellow orange; corticole; Uganda and Tanganyika.....*P. leptascea* Steiner & Zahlbr.
33. Habit of *P. atrichoides*.....34
33. Habit of *P. revoluta* Flke; lobes 1–2 mm. wide, black below; rhizinae few and scattered; medulla C red; spermatia 4–6 × 0.5 μ; Triston da Cunha.....*P. revolutella* Nyl.
33. Habit of *P. quercina*; margins ciliate, lobes up to 3 mm. wide; medulla K yellow then red or orange red, C–, KC– becoming orange when moribund; sterile; on epiphytic roots; Uganda.....*P. orchidophila* Dodge
34. Thallus plumbeous; saxicole; Cape of Good Hope.....*P. molybdiza* Nyl.
34. Thallus pale glaucous, lobes 0.5–1 mm. wide; apothecia unknown; medulla K–, C and KC pink; corticole; Cape of Good Hope.....*P. suffixa* Stirton
35. Habit of *P. conspersa* or *P. Mougeottii* but ashy white, lobes up to 6 mm. wide; saxicole; Cape of Good Hope.....*P. Mougeotii* v. *dealbata* Mass.
35. Habit of *P. homalotera*; muscicole; Tanganyika.....*P. homalotera* v. *bryophila* Cengia Sambo

PARMELIA (HYPOTRACHYNA) LECANORACEA Müll. Arg., Flora 71:529. 1888.

Type: South-West Africa, Great Namaland, *A. Schenck 543*.

Thallus citrine drab, lobes very imbricate, convex, irregular in the center with microphylline margins, lobules up to 0.5 mm. long, 0.2–0.3 mm. wide, irregular in shape; marginal lobes less imbricate, nearly plane, 10–15 mm. long, 2–3 mm. wide, irregularly dichotomous with short internodes, appearing subpinnate, ultimate lobules about 2 mm. long, 1 mm. wide, narrowly black margined, rimose in the older portions; underside black, with short black rhizinae, not very dense and nearly nude at the margins; upper cortex 22–32 μ thick, fastigiate, hyphae 5–6 μ in diameter, above heavily nubilated with brownish granules, more hyaline below; algal layer of discrete colonies of *Trebouxia*, cells 6 μ in diameter, with occasional cells deeper in the medulla; medulla K yellow, C–, KC faint yellow, 115–130 μ thick, of moderately closely woven, branched, predominantly longitudinal hyphae, very thickwalled, 4–5 μ in diameter; lower cortex 22–23 μ thick, very black, apparently pseudoparenchymatous from longitudinal hyphae, extending up the side of the lobe and joining the upper cortex near the margin above; rhizinae 55–60 μ in diameter, growing out of the lower cortex.

Apothecia up to 2 mm. in diameter, nearly sessile, margins entire and inrolled at first, becoming minutely crenulate and scarcely inrolled at maturity; exciple smooth, subnitid, very slightly sulcate near the margin, disc concave to nearly plane, Sanford's brown when moist, auburn or darker when dry; amphithecial cortex 40 μ thick, hyaline, fastigiate; algal layer of scattered discrete colonies; algal layer under the parathecium 20–25 μ thick, nearly continuous; parathecium 30–35 μ thick, similar to the thalline cortex but hyaline with larger protoplasts; hypothecium 30 μ thick, of thickwalled periclinal hyphae, hyaline below, more deeply staining above; thecium 50–55 μ tall; paraphyses slender, septate, once or twice dichotomous in the upper half, branches submoniliform, ending near the surface of the brownish epithecial gel; asci broadly clavate, 30 × 10 μ, thick-walled with a greatly thickened tip, remaining so until the ascospores are nearly mature, 8-spored; ascospores distichous, 8–10 × 6–7 μ, with a thick epispore.

Our specimen agrees well with Müller Argau's description except in color (not pale ashy), the apothecia are up to 2 mm. in diameter instead of 1 mm. The

color of our thalli would suggest inclusion in *Xanthoparmelia* rather than in the *Hypotrachynae*. Another thallus from the same collection agrees with the above description except the color is almost isabella color with some ultimate lobules almost ecru olive; the apothecia are younger, not more than 1 mm. in diameter.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, corticole, *J. Gossweiler*, Com. 1910 at Kew (2 specimens).

PARMELIA (HYPOTRACHYNA) **phricodes** (Stirton) Dodge, comb. nov.

Parmelia laceratula v. *phricodes* Stirton, Trans. Glasgow Soc. Field Nat. 5:213. 1877.

Type: South Africa, Mt. Boschberg near Somerset East, truncicole, *P. MacOwan*.

Thallus at least 4 cm. in diameter, between tawny olive and wood brown (1957); peripheral lobes 15 mm. long, 5 mm. wide, dichotomous with rounded sinuses, tips crenate, sometimes lacerate, dentate to microphylline, lobules up to 1 mm. long, 0.2 mm. wide, surface smooth to slightly rugulose, central portion very densely isidiose, isidia slender, coralloid, up to 1 mm. long; underside warm buff or lighter; rhizinae dense, short, very pale; upper cortex 30 μ thick, gelified, of fastigiate pseudoparenchyma, protoplasts 2–3 μ in diameter, somewhat irregularly arranged; algal layer 25 μ thick, continuous, cells 7–10 μ in diameter, mostly solitary, evenly spaced, occasionally in small colonies of a few cells each, occasionally interrupted for a space of 15 μ under the nongelified areas of the cortex (for aeration); medulla K–, C pink, KC–, up to 200 μ thick, hyphae loosely woven in the upper half, heavily nubilated with minute hyaline crystals, the lower half of closely woven, longitudinal hyphae; lower cortex very pale brown, gelified, of fastigiate pseudoparenchyma, lumina about 1 μ in diameter; rhizinae 40–50 μ in diameter, of very slender, conglutinate hyphae without a cortical layer.

Apothecia 13–20 mm. in diameter, fide Stirton.

SOUTH AFRICA: *Drège* ex herb. Sonder sub *P. Borreri* Ach. *f.* in Tuckerman Herb. at Farlow Herb., sterile.

PARMELIA (HYPOTRACHYNA) LAEVIGATOIDES des Abbayes, Bull. Inst. Franç. Afrique Noire **13**:970. 1951.

Type: Guinée Française, Fouta-Djalon à Dalaba (cercle de Mamou), 1200 m., saxicole, *H. des Abbayes*; Côte d'Ivoire, Mt. Tonkoni, (cercle de Man), 1100 m., saxicole, *H. des Abbayes*.

Thallus 6–10 cm. in diameter, citrine drab in the center, shading to olive buff on the peripheral lobes, subnitid; peripheral lobes up to 15 mm. long, 3–5 mm. wide, irregularly dichotomous with round to excised sinuses, ultimate lobules about 1 mm. long and wide, tips truncate; center isidiose, isidia cylindric, slender, concolor or tips darker, quite dense, rare or absent on the peripheral lobes; underside black, Dresden brown on the ultimate lobules, densely rhizinose throughout; upper cortex 15 μ thick, of thinwalled, fastigiate pseudoparenchyma, cells 5 μ in diameter, heavily nubilated with grayish granules; algal layer about 20 μ thick, continuous, cells closely packed, 6–7 μ in diameter; medulla K yellow then red, finally ferruginous as the solution dries, C– or pale yellowish, KC–, 40 μ thick, very loosely

woven next the algal layer and the lower cortex, middle more closely woven, heavily nubilated with hyaline granules, hyphae mostly longitudinal, 3 μ in diameter; lower cortex 8 μ thick, a single layer of isodiametric cells; rhizinae 20 μ in diameter, formed by a strand of medullary hyphae pushing downward between the cortical cells.

Apothecia sessile, 2–5 (–7) mm. in diameter, margins entire, exciple isidiose, disc concave becoming nearly plane, imperforate, hazel to auburn; amphithecial cortex 55 μ thick, of fastigiate, very thickwalled conglutinate hyphae, lumina 1 μ in diameter, apparently branched and anastomosing; algal layer of discrete colonies up to 30 μ in diameter, with some cells deeper in the medulla, tending to die out; algal layer under the parathecium 30 μ thick, nearly continuous; parathecium 25 μ thick, of fastigiate pseudoparenchyma, protoplasts about 2 μ in diameter; hypothecium 15 μ thick, of thickwalled periclinal hyphae, conglutinate below and scarcely staining, deeply staining above; thecium 65 μ tall; paraphyses slender, septate, simple or dichotomous above the asci, terminal cell slightly clavate, reaching the top of the deep brown epithecial gel; asci clavate to ellipsoid, about 42 $\times$ 14 μ, tip about 4 μ thick, 8-spored; ascospores ellipsoid, 13 $\times$ 6–7 μ, with a moderately thick epispore.

The thecia of most of the apothecia was partly eaten away by insects some time before the specimens were collected. Where the algal layer under the parathecium was reached, regeneration produced a thin cortex and isidia similar to those of the exciple; where only the parathecium was exposed, it regenerated to form a narrow, biatorine margin by growing up the sides of the thecium. *Dümmer 602* p. p. min. agrees with des Abbayes' description that the medulla is KC yellow becoming ferruginous as the solution dries. *Thomas 3029* are somewhat larger but sterile plants.

SIERRA LEONE: Kori, Njala, on branch of *Amphimas pterocarpoides, F. C. Deighton M5693A*, at Kew, sterile.

UGANDA: Seso, near Towa Forest, on rocks in grassland, 1215 m., *A. S. Thomas 3029*, at Kew, sterile; Kipango, 1290 m., on bark of *Albizzia Brownei, R. A. Dümmer 602* p. p. min., at Kew, fertile.

PARMELIA (HYPOTRACHYNA) **meizosporoides** Dodge, sp. nov.

Parmelia meizospora f. *isidiosa* Müll. Arg., Flora **67**:620. 1884, nom nud.

Type: Madagascar, Imerina, Andrangolaoka, *J. M. Hildebrandt*, ex herb Sbarbaro at Farlow Herb.

Thallus 6 cm. diametro, roseo-cinnamomeus (1957), centro rugoso; lobis peripheric is 25 mm. longitudine, infra 10 mm. latitudine, irregulariter dichotomis, sinibus parvis rotundatis, superne subpinnatis, lobulis ultimis rotundatis, crenatis, breviter ciliatis, 5 mm. longitudine, 10 mm. latitudine, laevibus, K flavescens; isidiosus isidiis tenuibus, simplicibus aut raro dichotomis; inferne niger, dense rhizinosus, marginibus papillatis verrucosisve; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 3 μ diametro; stratum algarum coloniis *Trebouxiae*, 15 μ diametro, discretis sed densis; medulla K–, C–, KC–, 50 μ crassitudine, hyphis longitudinalibus compactis, granulis bruneis nubilatis; cortex inferior 12–15 μ crassitudine, niger, pseudoparenchymatice fastigiatus, cellulis 3–4 μ diametro.

Apothecia sessilia, 1–3 mm. diametro, marginibus integris dein crenatis in apotheciis maioribus; excipulo laevi, disco imperforato, aurantiaco-rufo; cortex amphithecialis 40 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 5–7 μ diametro; stratum algarum coloniis discretis, 15 μ diametro; medulla compacta, granulis brunneis nubilata; stratum algarum sub parathecio continuum, 15 μ crassitudine; parathecium 10 μ crassitudine, fastigiatum, gelifactum; hypothecium 25 μ crassitudine, hyphis tenuibus periclinalibus; thecium 50 μ altitudine; paraphyses tenues, simplices, apicibus clavatis 4–5 μ diametro; asci clavati, 42 $\times$ 10 μ, leptodermei, apicibus incrassatis; ascosporae octonae, ellipsoidae, 9–10 $\times$ 5–6 μ.

Thallus probably at least 6 cm. in diameter, pinkish cinnamon to light pinkish cinnamon (1957), central portion coarsely rugose, peripheral lobes 10 mm. wide below, 25 mm. long, irregularly dichotomous below with small rounded sinuses, subpinnate above, ultimate lobules rounded, crenate, very short ciliate, 5 mm. long, 10 mm. wide, surface smooth, K yellow, very isidiose in the center, less so on the marginal lobes, none on the ultimate lobules; isidia very slender, mostly simple, some dichotomous; underside black, very densely rhizinose, papillate to verrucose at the margins; upper cortex 15 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells about 3 μ in diameter, rather irregularly arranged; algal layer of close but discrete colonies of *Trebouxia*, 15 μ in diameter, cells 5–6 μ in diameter; medulla K–, C–, KC–, 50 μ thick, of moderately closely woven longitudinal hyphae, except next the lower cortex, nubilated with minute brownish granules; lower cortex 12–15 μ thick, black, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter.

Apothecia sessile on central portion of the thallus, 1–3 mm. in diameter, margin entire becoming crenate in the larger apothecia, exciple smooth, disc imperforate, orange rufous to auburn; amphithecial cortex 40 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells 5–7 μ in diameter; algal layer of discrete colonies, 15 μ in diameter; medulla closely woven, heavily nubilated with brownish crystals; algal layer under the parathecium 15 μ thick, continuous; parathecium 10 μ thick, fastigiate, highly gelified; hypothecium 25 μ thick, of closely woven, slender, periclinal hyphae; thecium 50 μ tall; paraphyses slender, unbranched, tips clavate, 4–5 μ in diameter, ending about 4 μ below the surface of the hyaline epithecial gel; asci clavate, 42 $\times$ 10 μ, 8-spored, wall thin, tip thickened; ascospores ellipsoidal, 9–10 $\times$ 5–6 μ.

MADAGASCAR: Imerina, Andrangolaoka, *J. M. Hildebrandt*, ex herb. Sbarbaro at Farlow Herb.

PARMELIA (HYPOTRACHYNA) LEPTOPHYLLA Müll. Arg., Flora **74**:377. 1891.

Type: S. Africa, Baziya, *Bæer 714* at Kew.

Thallus 7–8 cm. in diameter, between deep olive buff and avellaneous, peripheral lobes 30 mm. long, 5 mm. wide below, dichotomous, ultimate lobules about 3 mm. long, 2 mm. wide, margins crenate, sinuses slightly rounded, revolute, with rare short cilia, central lobes smaller, lobulate, lobules variously shaped, surface smooth, opaque, minutely reticulate rimulose in older portions with abundant isidioid

soredia (a few just beginning to develop in our rather young plants); underside black, rhizinose, papillose toward the tips of the lobes, the outer mm. nude, Prouts brown or darker; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 5 μ in diameter, relatively thinwalled, nubilated by nearly hyaline granules; algal layer 30 μ thick, of close, discrete colonies of *Trebouxia*, cells more densely packed above, 6–7 μ in diameter; medulla K–, C–, KC–, 160 μ thick, the upper 90 μ of close longitudinal hyphae, so heavily nubilated with hyaline granules as to nearly obscure the structure, the lower part only slightly nubilated; lower cortex 16 μ thick, pseudoparenchymatous from thickwalled longitudinal hyphae, about 8 μ in diameter; rhizinae 55 μ in diameter.

Apothecia 2–2.4 mm. in diameter, margin and exciple sorediose, disc concave, reddish fuscous, epruinose; ascospores 8 $\times$ 5 μ.

The description of the apothecia is translated from the original description as all our material is sterile.

UGANDA: Kigezi, Mafuga, 2250 m., growing over mosses on trees, *I. R. Dale L18* p. p. min., fragmentary and identification uncertain.

SOUTH AFRICA: Ungoe Mts., *W. Plants*, two sterile fragments on right, at Kew; Kentani, growing over *Lobaria comorensis* (Krmph.) Zahlbr. and overgrown by *Anaptychia* sp., *Alice Pegler*, ex S. African Mus. at Kew.

PARMELIA (HYPOTRACHYNA) CONCRESCENS Vainio, Cat. Welwitsch African Pl. 2:400. 1901.

Parmelia capensis Nyl., Flora 68:613. 1885, non Ach.
Parmelia austroafricana Zahlbr., Cat. Lich. Univ. 6:152. 1929, non Stirton, 1877.
Parmelia caffrorum Zahlbr., Cat. Lich. Univ. 8:555. 1932.

Type: Angola, Huila, Serra da Chela, 1225–1775 m., truncicole, *Welwitsch 30*. Type of *P. capensis* Nyl. non Ach, *P. austroafricana* Zahlbr. non Stirton and *P. caffrorum* Zahlbr. is from South Africa, *Drège*.

Thallus light mineral gray, buffy olive in areas densely covered by isidia, K slowly yellow, 4–6 cm. in diameter, but concrescent into much larger patches; marginal lobes flat, imbricate, about 10 $\times$ 3–5 mm., irregularly dichotomous, subpinnate, with excised sinuses, ultimate lobules 0.5–1.0 mm. wide, tips truncate to slightly rounded and when very short with shallow sinuses appearing crenulate; isidia covering the whole center and the basal portions of the marginal lobes, slender, short, simple or rarely dichotomous near the tips, very crowded, completely obscuring the underlying thallus; underside black, rhizinae moderately close, sometimes torn away in collecting and represented by small pseudocyphelloid areas; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter; algal layer of discrete colonies of *Trebouxia*, about 25 μ in diameter, cells 6–7 μ in diameter, separated by vertical medullary hyphae, isidia formed by a tuft of vertical branches of medullary hyphae pushing a small algal colony up through the cortex; medulla K–, C–, KC slowly yellow, 130–145 μ thick, of predominantly longitudinal, very thickwalled hyphae, 3–4 μ in diameter, closely woven and nubilated with hyaline granules; lower cortex fastigiate, 10 μ thick, a single layer of thickwalled dark brown cells, 10 $\times$ 5 μ.

Apothecia 5 mm. in diameter, urceolate, margin entire at first, becoming inrolled, granular isidiose, exciple smooth at first then longitudinally sulcate and

finally reticullate rugose and subscrobiculate; disc chestnut, concave; amphithecial cortex 30 μ thick, fastigiate, hyphae 3 μ in diameter, outer 10 μ brownish and somewhat nubilated; algal layer 30 μ thick, continuous, with occasional colonies pushing up through the cortex to form isidia, cells 6–7 μ in diameter; medulla closely wove, heavily nubilated with brownish granules; algal layer under the parathecium 20 μ thick, continuous; parathecium 30 μ thick, of fastigiate pseudoparenchyma, protoplasts 2 μ in diameter; hypothecium 15–20 μ thick, of slender, very closely woven, predominantly periclinal hyphae; thecium 80 μ tall; paraphyses slender, dichotomous above the asci, tips not thickened, reaching nearly the surface of the brownish epithecial gel; asci clavate, 65 $\times$ 13 μ, wall thick and tips very thick when young, protoplast acuminate, wall thin at maturity; ascospores ellipsoidal, 9–10 (–12) $\times$ 6–7 μ, with a thick epispore.

P. capensis Nyl. non Ach was based on plants with mature apothecia while *P. concrescens* Vainio was based on plants with immature apothecia. The chemical reactions agree so far as given. *Curtis 700b* has apothecia in all stages of development, the younger agreeing with those described by Vainio and the mature ones with those described by Nylander.

CONGO: Kahusi, ca. 2700 m., *F. L. Hendrickx 4316* p. p. min. in E. African Herb.

KENYA: buffalo country south of Narossaro, growing over orchid roots on bark, 1610–2250 m., *Anita Grosvenor Curtis 700b* in Dodge Herb.; Eldoret near Lamok River, 2220 m., on uliowa tree, *G. R. Williams 90a,* fragment, at Kew.

UGANDA: Kigezi, Mafuga, 2415 m., on rocks, *I. R. Dale L46,* sterile; Maiguru Ridge, 2250–2580 m., corticole, *I. R. Dale L48* p. p. min.; Bugishu, Bulambuli, 935 m., in bamboo forest, *A. S. Thomas 549* p. p. min.; all at Kew.

TANGANYIKA: Usambara, Muandara, *C. Holst 2649* p. p. det. *P. laevigata* v. *isidiosa* Müll. Arg. by Müller Argau at Kew (juvenile).

PARMELIA (HYPOTRACHYNA) **Gillettii** Dodge, sp. nov.

Type: Somaliland, Libah Mele Mt., 1675 m., above Buja Soldan, 10° 20′ N., 43° E., on twigs of *Grewia sp.?, J. B. Gillett 4699* p. p., Abyssinia-Somaliland Boundary Commission, at Kew.

Thallus 6 cm. longitudine, 2.5 cm. latitudine, ramulos involvens, pallide olivaceo-alutaceus, lobis peripheric eciliatis, 7 mm. longitudine, 1.5–2 mm. latitudine, irregulariter dichotomis, sinibus excisis, apicibus truncatis, superficie centro rugosa, ad margines laevior, dense isidiosus, isidia granulosa aut tenuia, submoniliformia, non ramosa; inferne obscure fuscus, ad margines pallidior, rhizinis densis; cortex superior 10 μ crassitudine, fastigiatus, cellulis 3 μ diametro, granulis brunneis sparsim nubilatus; stratum algarum subcontinuum, coloniis *Trebouxiae* 15 μ diametro, discretis, cellulis ad 8 μ diametro; medulla K flavens dein aurantico-rubens, C–, KC–, 40 μ crassitudine, arachnoidea, hyphis pachydermeis, 3 μ diametro; cortex inferior 15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis pachydermeis, 5 μ diametro.

Apothecia 2.5 mm. diametro, cupuliformia, margine inflexo, integro, excipulo primum laevi, dein isidiosissimo, disco brunneo, concavo; cortex amphithecialis 30 μ crassitudine, pseudaparenchymatice fastigiatus, protoplastis 3 μ diametro; coloniis algarum sparsis ca. 20 μ diametro; medulla laxe contexta (densius quam in thallo); stratum algarum sub parathecio 20 μ crassitudine, continuum; parathecium 20 μ

crassitudine, pseudoparenchymatice fastigiatum sed cellulis subirregulariter dispositis; hypothecium 15 μ crassitudine, hyphis tenuibus, periclinalibus dense contextis; thecium 55 μ altitudine; paraphyses tenues, sparsim septatae, semel super ascos dichotomae, apicibus non incrassatis; asci clavati, 40 $\times$ 8 μ, apicibus juventute incrassatis; ascosporae octonae, ellipsoideae, 13.5 $\times$ 8 μ, episporio crasso.

Thallus about 6 cm. long, 2.5 cm. wide, wrapped around small branches, pale olive buff, peripheral lobes eciliate, 7 mm. long, 1.5–2 mm. wide, irregularly dichotomous, sinuses excised, tips sinuate or truncate; surface rugose in the center, smoother toward the margins, densely isidiose, isidia varying from granulose to very slender, moniliform, simple; underside dark fuscous, paler at the margin, completely covered with dense rhizinae; upper cortex 10 μ thick, fastigiate, cells 3 μ in diameter, walls moderately thick, brownish, slightly nubilated with brownish granules; algal layer 15 μ thick, of discrete colonies of *Trebouxia,* cells 8 μ in diameter, in a nearly continuous layer; medulla K yellow then orange red, C–, KC–, about 40 μ thick, arachnoid with nearly as many vertical as longitudinal hyphae, thickwalled, 3 μ in diameter; lower cortex 15 μ thick, of fastigiate pseudoparenchyma, cells thickwalled, about 5 μ in diameter.

Apothecia 2.5 mm. in diameter, cupiliform, margin inflexed, entire, exciple smooth at first becoming densely isidiose; disc Brussels brown, remaining concave; amphithecial cortex 30 μ thick, of fastigiate pseudoparenchyma, protoplasts 3 μ in diameter; algal layer of very scattered colonies, 20 μ in diameter; medulla loosely woven but denser than the thalline medulla; algal layer under the parathecium about 40 μ thick, continuous; parathecium 20 μ thick, of fastigiate pseudoparenchyma, cells quite irregularly arranged; hypothecium 15 μ thick, of slender, closely woven, periclinal hyphae; thecium 55 μ tall; paraphyses slender, sparingly septate, about once dichotomous above the asci, tips not thickened; reaching the top of the nearly hyaline epithecial gel; asci 8-spored, clavate, 40 $\times$ 8 μ, tip thickened when young; ascospores 13.5 $\times$ 8 μ, ellipsoid, with a moderately thick epispore.

SOMALILAND: Libah Mele Mt., 1675 m., above Buja Soldan, 10° 20′ N., 43° E., on twigs of *Grewia* sp.?, *J. B. Gillett 4699* p. p. type, Abyssinia-Somaliland Boundary Commission, at Kew.

PARMELIA (HYPOTRACHYNA) **subisidiosa** (Müll. Arg.) Dodge, comb. nov.

Parmelia cetrata v. *subisidiosa* Müll. Arg., Bot. Jahrb. [Engler] **20**:256. 1894.
?*Parmelia tiliacea* v. *eximia* Stein, Jahresber. Schles. Ges. Vaterl. Kultur **66**:138. 1888.

Type: Tanganyika, Usambara, Bumba, *Holst 8772* p. p. The type of *P. tiliacea* v. *eximia* Stein is from South Usambara, *Hans Meyer,* not seen.

Thallus 7 cm. or more in diameter, between olive buff and vinaceous buff, marginal lobes about 10 mm. long, 5 mm. wide, sometimes dichotomous near the ends, margins crenate to lacerate and isidiose, ciliate, cilia slender, up to 0.6 mm. long, distant; surface smooth, central portion isidiose, isidia up to 1 mm. long, very fragile, leaving scars through which medullary hyphae protrude, giving the appearance of pseudocyphellae or minute soredia, some isidia aborted and the tip growing out as a cilium resembling the marginal cilia but smaller; underside black shading to chestnut at the margin, rhizinae covering the whole underside, or a few lobes nude in the outer mm., short, dense; upper cortex 15 μ thick, of fastigiate

pseudoparenchyma, cells relatively thinwalled, 7–8 μ in diameter; algal layer 15 μ thick, continuous, both layers heavily nubilated with brownish granules; medulla K–, C–, KC–, 30–40 μ thick, of predominantly longitudinal hyphae, very loosely woven, especially so below, irregularly nubilated with grayish granules; lower cortex black, pseudoparenchymatous from longitudinal hyphae; rhizinae 65 μ in diameter, formed by outgrowth of the hyphae of the lower cortex.

MOZAMBIQUE: Makua Country, Mt. Namuli, growing over bryophytes and epiphytic roots, *J. T. Last*, at Kew.

PARMELIA (HYPOTRACHYNA) ISIDIZA Nyl., Bol. Soc. Broter. **3**:130. 1884.

Type: Angola, Moçâmedes, Serra da Chela, Caionda, on mopane tree, *Frank Newton.*

Thallus at least 6 × 3 cm., chamois, peripheral lobes 10 mm. long, 5 mm. wide at the base, irregularly dichotomous, ultimate lobules subtruncate to rounded, margins minutely isidiose and ciliate, cilia about 1 mm. long, about 1 mm. apart, surface smooth to rugulose, isidiose, isidia quite dense in the center, rare on marginal lobes, short, simple, rarely forked; underside black, rhizinae moderately dense in the center, becoming papillae toward the margin with a nude zone 1 mm. wide; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, cells about 5 μ in diameter, heavily nubilated with brownish granules in the outer half; algal layer of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter; medulla K–, C pink soon fading, KC–, 80 μ thick, of closely woven, longitudinal hyphae 3 μ in diameter, nubilated with brownish granules, more densely so above; lower cortex black, 13–15 μ thick, pseudoparenchymatous, cells about 5 μ in diameter with thick black walls, irregularly arranged.

Apothecia 2–4 mm. in diameter, margin subcrenate, disc fusco-rufescent; ascospores ellipsoid, 9–12 × 6–8 μ, fide Nylander.

Nylander gives the medulla as K yellow becoming ferruginous, while our material is K– when only the medulla is moistened. If a drop of K from the upper surface spills over to the medulla, it is dyed yellow, as the reagent dissolves some of the dye from the cortex. It becomes ferruginous as the solution dries. Nylander does not mention cilia. Our material is sterile and the description of the apothecia is translated from the original description.

ANGOLA: Cabinda, Maiombe, Chiloango, *J. Gossweiler 8033* p. p., at Kew.

NORTHERN RHODESIA: Abercorn, growing over *Cryptorchis* roots on *Brachystegia taxifolia,* in dense shade of crown, *A. A. Bullock 2104* p. p. min., International Red Locust Control Service, at Kew.

PARMELIA (HYPOTRACHYNA) **sublaevigatoides** Dodge, sp. nov.

Type: Uganda, Mt. Elgon, 1290 m., substrate and collector unknown, Dec. 1914, at Kew.

Thallus ad 6 cm. diametro, ochraceo-alutaceus centro, marginibus pallidioribus, lobis 5 × 2–3 mm., pinnatim lobulatis, raro irregulariter dichotomis, lobulis ca. 1 mm. latitudine minus quam 1 mm. longitudine, apicibus rotundatis, sinibus subexcisis, superficie opaca, laevi, sparsim minuteque isidiosus, marginibus sparsim ciliatis, ciliis conicis, 0.25 mm. longitudine; infra niger, marginibus brunneis,

nitidis; rhizinae centro 0.75 mm. longitudine, ad margines breviores; cortex superior 13 μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 20 μ crassitudine, coloniis cellulisque sparsis, 3–4 μ diametro; medulla K–, C–, KC–, 30–35 μ crassitudine, hyphis longitudinalibus, 5–6 μ diametro, contextis; cortex inferior 10 μ crassitudine, hyphis longitudinalibus 3–5 μ diametro, cellulis isodiametricis; rhizinae 35 μ diametro.

Thallus 6 cm. in diameter, ochraceous buff in the center, shading to light ochraceous buff at the margins, K–, C bleached to white, lobes 5 × 2–3 mm., pinnately lobulate, irregularly subdichotomous, lobules about 1 mm. wide, less than 1 mm. long, tips rounded, sinuses subexcised, surface dull, smooth, sparsely and minutely isidiose even on the marginal lobes; margins sparsely ciliate, cilia conic, 0.25 mm. long; underside black in the center shading to antique brown at the margins, shining; rhizinae 0.75 mm. long in the center, progressively shorter toward the margins, black; upper cortex 13 μ thick, of fastigiate pseudoparenchyma, cells very thickwalled, conglutinate, outer two thirds yellowish brown; algal layer 20 μ thick, of small scattered colonies and single cells of *Trebouxia*, 3–4 μ in diameter; medulla K–, C–, KC–, 30–35 μ thick, of predominantly longitudinal hyphae 5–6 μ in diameter, very closely interwoven, heavily nubilated with grayish granules; lower cortex 10 μ thick, black, of 2–3 layers of isodiametric cells, apparently from longitudinal hyphae, growing out to form rhizinae up to 35 μ in diameter. Apothecia and spermogonia not seen.

The thallus from Portuguese East Africa is somewhat larger, about 6 cm. long, 1.8 cm. wide, completely surrounding a coffee branch about 6 mm. in diameter.

CONGO: Mt. Kahusi, 2700 m., on twig, *F. L. Hendrickx 4314* p. p. min. in E. African Herb.

UGANDA: Bugishu, Bulambuli, 2900 m., in bamboo forest, *A. S. Thomas 549* p. p.; Buginyanya, on rocks, 2100 m., *A. S. Thomas 465*, Mt. Elgon, 1290 m., substrate and collector unknown, Dec. 1914, type, all at Kew.

TANGANYIKA: Ufipa, Chapota, 2100 m., growing over *Polystachya* roots on *Brachystegia*, *A. A. Bullock 2035* p. p. min. International Red Locust Control Service at Kew.

NYASALAND: Luchenya Plateau, Mlanje District, Mt. Mlanje, 2100 m., growing over and with *Parmelia usambarensis*, *L. J. Brass 16474a*, Vernay Nyasaland Exp. in Dodge Herb., juvenile.

PORTUGUESE EAST AFRICA: Inhambane District, Inhamine, *D. Luiz Sousa* p. p. min. Oct. 1937, at Kew.

PARMELIA (HYPOTRACHYNA) foliolosa Dodge, sp. nov.

Type: Madagascar, East Imerina, Andrangolaoka, terricole, *J. M. Hildebrandt*, Nov. 1880, com. C. Rensch sub *P. perforata* (L.) Nyl. v. *ulophylla* Mey. & Fw. ex herb. Hasse and ex herb. Sbarbaro at Farlow Herb.

Thallus ad 6 cm. diametro, obscure olivaceo-alutaceus, anguste brunneo-marginatus, ciliatus, ciliis ad 0.5 mm. longitudine, lobis irregulariter dichotomis, inferne 5 mm., superne 10 mm. latitudine, marginibus lobulatis, lobulis aliis 0.5 mm. latitudine, cum soraliis subsphaericis terminalibus 0.6 mm. diametro, alteris 1 × 1 mm., apicibus truncatis retusisve, aliis suborbicularibus, 1 mm. diametro, lobis peripheric is rotundatis, crenatis, lobulis 1–2 mm. latitudine, basi non constrictis, esorediosis; superficie albo-reticulata, rimuloso-areolata verrucosave; soredia granulosa; inferne opacus, centro niger, marginibus rufo-brunneis subnudis; rhizinae

confertae, breves; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 4 μ diametro; stratum algarum 20 μ crassitudine, coloniis *Trebouxiae*, subcontinuum, cellulis 5 μ diametro; medulla K–, C–, KC–, 80 μ crassitudine, hyphis pachydermeis, longitudinalibus, 3 μ diametro, granulis griseis nubilatis, superne dense contextis, inferne laxioribus; cortex inferior niger, 10 μ crassitudine, hyphis pachydermeis, longitudinalibus, cellulis isodiametricis; cilia rhizinaeque 35 μ diametro.

Thallus up to 6 cm. in diameter, deep olive buff, very narrowly dark brown margined with abundant cilia up to 0.5 mm. long, mostly shorter, lobes irregularly dichotomous, about 5 mm. wide below, expanding to 10 mm. wide above, margins lobulate below, some lobules about 0.5 mm. wide at the base, bearing terminal, subspherical soralia 0.6 mm. in diameter, others about 1 mm. wide and long, tips truncate or retuse, others nearly circular, 1 mm. in diameter with a very narrow base; marginal lobes rounded, deeply crenate with lobules 1–2 mm. wide, not constricted at the base, tips semicircular, not bearing soredia; upper surface white reticulate, smooth in outer portion, becoming very coarsely verrucose in the older portions, rimulose areolate, some groups of verrucae forming soredia in irregular areas, 4 mm. or more wide, soredia coarsely granular; underside opaque, black in the central portions, margins auburn, shining, nude in the outer 1 mm.; rhizinae short, close, becoming papillae on the marginal lobules, broken away in the central portion when removing the soil, apparently breaking near the surface of the thallus but not pulling away the surrounding lower cortex as usually happens; upper cortex 15 μ thick of fastigiate pseudoparenchyma, cells 4 μ in diameter, the outer 7–10 μ greenish brown, the rest hyaline; algal layer 20 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells about 5 μ in diameter; medulla K–, C–, KC–, 80 μ thick, of longitudinal, very thickwalled hyphae 3 μ in diameter, so heavily nubilated with grayish granules that the structure is not clear in thick sections, very closely interwoven in the upper 65 μ, looser and less nubilated in the lower 15 μ, tending to tear in sectioning; lower cortex black, 10 μ thick, of thickwalled, longitudinal hyphae with nearly isodiametric cells, extending up over the margin of the upper surface for 100 μ; cilia and rhizinae 35 μ in diameter, both outgrowths of the lower cortex.

MADAGASCAR: East Imerina, Andrangolaoka, terricole, *J. M. Hildebrandt* Nov. 1880, com. C. Rensch sub *Parmelia perforata* (L.) Nyl. v. *ulophylla* Mey. & Fw. ex herb. Hasse and ex herb. Sbarbaro at Farlow Herb.

PARMELIA (HYPOTRACHYNA) SUBAEQUANS Nyl. in Crombie, Jour. Bot. Brit. For. **14**:19. Jan. 1876; Jour. Linn. Soc. Bot. **15**:167. 1876.

Type: Cape of Good Hope, *A. E. Eaton*, Venus Transit Exp.

Thallus at least 5 cm. in diameter, probably larger, Natal brown to wood brown (1957), central lobes 4–5 mm. wide, irregularly dichotomous to subpinnate toward the ends, narrower at each dichotomy, ultimate lobes about 1 mm. wide and long, tips truncate to retuse, sinuses rounded, margins not truly ciliate, but long rhizinae bending outward and showing for a distance of 1 mm. beyond the margin, surface pseudocyphellate, punctiform to more often lirellate; underside black, rhizinae slender, branched, up to 1.5 mm. long, covering the whole under-

side; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter, very thickwalled and heavily nubilated with greenish brown granules; algal layer about 20 μ thick, of scattered cells and small colonies of *Trebouxia* in a continuous layer; medulla K–, C–, KC– or faint ochroleucous, about 100 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter, heavily nubilated with grayish granules, the lower 30 μ very loosely woven with large air spaces; lower cortex black, 23 μ thick, pseudoparenchymatous from longitudinal hyphae about 5 μ in diameter; rhizinae 30 μ in diameter.

Apothecia 2–3 mm. in diameter, urceolate, margin entire, inrolled, longitudinally sulcate striate when young, nearly smooth when mature; exciple smooth, becoming pseudocyphellate, not sorediose above, disc auburn or darker, remaining concave; amphithecial cortex 80 μ thick, of fastigiate pseudoparenchyma, hyaline, the outer gel faintly brownish; algal layer 30–40 μ thick, of discrete colonies, located about 25 μ inside the cortex, tending to die out below, leaving large lacunae in the medulla; medulla very loosely woven, tending to tear apart in sectioning; algal layer under the parathecium, 40 μ thick, of close but discrete colonies; parathecium 40 μ thick, of somewhat irregular fastigiate pseudoparenchyma; hypothecium 30 μ thick, of slender periclinal hyphae, very closely woven below and above, looser in the middle; thecium 50 μ tall; paraphyses slender, septate, dichotomous in the upper half, tips slightly clavate, ending in the brownish epithecial gel; asci clavate, 40 $\times$ 15 μ, wall 3 μ thick, tip 7 μ, protoplast mamillate when young; ascospores ellipsoid, epispore 2 μ thick, 16–20 $\times$ 8–10 μ (12–16 $\times$ 4–6 μ measured without the epispore).

Nylander describes the ascospores as 14–15 $\times$ 9–11 μ; in our specimen the ascospores are narrower, but it agrees with the original description in all other respects.

SOUTH AFRICA: *Drège*, ex herb. Sonder sub *P. saxatilis* Ach. in Tuckerman Herb. at Farlow Herb.

PARMELIA (HYPOTRACHYNA) INSIGNATA Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888/9:162. 1890.

Type: Cape of Good Hope, Mt. Leon near Capetown, *P. MacOwan.*

Thallus probably more than 5 cm. in diameter, ashy to olive-green, becoming buffy citrine in the center to ochraceous buff at the margins (after more than 40 years in the herbarium); peripheral lobes rounded, crenate to lobulate, surface subscrobiculate with the radial ridges more prominent than the transverse, nearly smooth at the margins, powdery sorediate on some lobules (perhaps in older specimens more continuously sorediate and pseudocyphellate along the ridges), soralia round, up to 0.8 mm. in diameter, soredia coarsely granular to isidioid; underside not seen as it is closely attached to rough bark, margins dark toward center of marginal lobes, abruptly warm buff or paler toward the margin, with pale rhizinae all the way to the margin; upper cortex 25 μ thick, of gelified, fastigiate pseudoparenchyma, protoplasts spherical, 2 μ in diameter, somewhat irregularly arranged; algal layer 25 μ thick, of colonies of *Trebouxia* and single cells in a nearly continuous layer, cells 10 μ in diameter; heavily nubilated with grayish granules;

medulla K–, C–, KC pink, 100 μ thick, the upper 30 μ of very loosely woven vertical and oblique hyphae with large air spaces and tearing apart here on sectioning, the rest of closely woven, predominantly longitudinal hyphae 3 μ in diameter; lower cortex 15 μ thick, similar to the upper cortex.

Apothecia sessile, 5–6 mm. in diameter, urceolate with inrolled margins at first, then nearly flat, margin minutely crenulate, cracked nearly to the center of the disc in the flatter apothecia; exciple shallowly rugose; disc imperforate, chestnut; amphithecial cortex 65 μ thick, of gelified, fastigiate pseudoparenchyma, lumina 1 μ in diameter above, about 2 μ in diameter, 4 μ long below; algal layer of small colonies at the margin, disappearing below; medulla loosely woven; algal layer under the parathecium 30–50 μ thick, nearly continuous; parathecium 20 μ thick, gelified, lumina about 2 μ in diameter, rather irregularly arranged; hypothecium 10–13 μ thick, of slender, closely woven, periclinal hyphae; thecium 45 μ tall; paraphyses several times dichotomous in the upper half, branches moniliform, tips not thickened, ending about 3 μ below the surface of the orange epithecial gel; asci broadly clavate, 40 $\times$ 20 μ, wall 3 μ thick, tip 7 μ, 8-spored; ascospores broad ellipsoidal, 10–13 $\times$ 7–9 μ, with a thick epispore.

SOUTH AFRICA: Cape Province, Paarl District, on *Quercus*, *P. A. van der Bijl 80* sub *P. dubia*, in G. K. Merrill Herb. at Farlow Herb.

PARMELIA (HYPOTRACHYNA) BIJLII Vainio, Ann. Univ. Fenn. Aboens. A 2:3:1. 1926.

Type: S. Africa, Cape Province, Klapmuts, on *Quercus*, *P. A. van der Bijl 128*.

Thallus about 4 cm. in diameter, deep olive buff, shading toward vinaceous buff on some lobes, peripheral lobes irregularly dichotomous with short internodes, appearing subpinnate, sinuses rounded to subexcised, ultimate lobules 1.5–2 mm. long, 1–1.5 mm. wide, terminal lobules a little larger, lower lateral lobules capitate sorediate, upper surface often soraliate, soralia 0.2–0.5 mm. in diameter, soredia granular, very rarely confluent; underside black, rhizinose to the margin, not truly ciliate but sometimes appearing so by the rhizinae bending outward beyond the margin; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 8 μ in diameter, thinwalled, heavily nubilated with pale brownish granules in the outer half; algal layer 30 μ thick, cells 7–8 μ in diameter in a nearly continuous layer, heavily nubilated with pale granules; medulla K–, C rose red fading, KC–, 105–120 μ thick, of predominantly longitudinal hyphae, the upper 20 μ almost arachnoid, the rest very closely woven and very heavily nubilated with grayish granules; lower cortex black, 15 μ thick, of fastigiate pseudoparenchyma, cells relatively thinwalled, 7–8 μ in diameter; rhizinae 55 μ in diameter, formed by the outgrowth of cortical cells.

SOUTH AFRICA: Kentani District, *Alice Pegler*, fragment ex S. African Mus.
TANGANYIKA: Usambara, Muandara Wald, growing with hepatics and a species of the *Anaptychia leucomelaena* group *C. Holst 2649* p. p. min. (upper left plants), at Kew.

PARMELIA (HYPOTRACHYNA) TENUIRIMA Hook. *f.* & Taylor, f. SOREDIATA Müll. Arg., Bot Jahrb. [Engler] 20:259. 1894.

Type: Tanganyika, Usambara, *Holst 787*, p. p.

Thallus 5–6 cm. in diameter, deep olive buff to olive buff, peripheral lobes rounded, about 6 mm. wide and long, margins crenate, sinuses rounded to excised on the sides, eciliate, but an occasional submarginal rhizina bends outward and simulates a cilium, upper surface smooth, with minute cracks near the ends of the lobes, giving rise to lines of minute, granular soredia, more frequent and confluent toward the center of the thallus, forming patches 5–10 mm. in diameter, of minutely granular soredia; underside black becoming Dresden brown in a narrow zone at the margin, densely black rhizinose; upper cortex 8–10 μ thick, of fastigiate pseudoparenchyma, cells small, very heavily nubilated; algal layer about 15 μ thick, of closely packed colonies of *Trebouxia,* cells 6–7 μ in diameter; medulla K very pale yellow, C–, KC orange red, 45–50 μ thick, of densely woven, slender, longitudinal hyphae, heavily nubilated with brownish granules; lower cortex 15 μ thick, very dark brown, of fastigiate pseudoparenchyma about 2 cells thick, growing out to form rhizinae 55 μ in diameter. Apothecia not seen.

This form probably represents a new species, as it differs from *P. tenuirima* Hook f. & Taylor in color, habit and most microscopic characters. I hesitate to give it a name until I have seen more abundant material.

UGANDA: Bugishu, Bulambuli, 2900 m., in bamboo forest, *A. S. Thomas 549* p. p. min., at Kew.

PARMELIA (HYPOTRACHYNA) MANGENOTI des Abb., Bull. Inst. Franç. Afrique Noire **13**:969. 1951.

Type: Côte d'Ivoire, Mankono (Cercle de Seguéla) on granite, 400 m., *H. des Abbayes*; Béoumi (Cercle de Bouaké) on trunk of mango, *H. des Abbayes.*

Thallus 10 (–15) cm. in diameter, pale ashy (yellowish glaucous in our specimen about a century old), K yellow above, KC yellow then orange red, peripheral lobes 15 mm. long, 3–5 (–7) mm. wide, crowded and more or less imbricate, subpinnate, sinuses rounded to excised, ultimate lobules 1–2.5 mm. long, 0.5–1 mm. broad, tips rounded to truncate, eciliate, capitate sorediate, soralia about 0.5 mm. in diameter, sometimes spreading from the margin to the upper surface of the lobe, in the center of the upper surface soon confluent into farinose crusts (only slightly farinose patches in our specimen as if the cortex had disintegrated in irregular areas, rather than from confluent soralia); underside black, rhizinose, margins chestnut to Sanford brown, nearly nude but with minute papillae; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells about 3 μ in diameter, slightly nubilated with grayish granules; algal layer 15–25 μ thick, of close discrete colonies of *Trebouxia,* cells 5–6 μ in diameter; medulla K–, C red, KC deep orange red, fading, the colors deeper just under the algal layer, 135 μ thick, of predominantly longitudinal hyphae, 3 μ in diameter, loosely woven under the algal layer, more closely so next the lower cortex, somewhat nubilated with minute grayish granules above, less so below; lower cortex dark brown, 15 μ thick, of fastigiate pseudoparenchyma, cells 6–8 μ in diameter.

FERNANDO PO: Pico de Santa Isabel, 2740 m., on trees, *Gustavo Mann 684,* at Kew.

PARMELIA (HYPOTRACHYNA) USAMBARENSIS Steiner & Zahlbr., Bot. Jahrb. [Engler] **60**:524. 1926.

Type: Tanganyika, East Usambara, Lutindi, 700–800 m., corticole, *Brunnthaler*.

Thallus more than 10 cm. in diameter, cartridge buff, loosely attached to the bark, ultimate lobes more or less ascending; lobes 10 mm. wide, unequally dichotomous, divaricate, sinuses rounded, some of the central ultimate lobules up to 10 × 1.5 mm., peripheral ultimate lobules 1–2 × 1 mm., with very short internodes, appearing almost digitate; margins ciliate, cilia up to 2 mm. long, tips acute, mostly simple, rarely with a few short lateral branches, close to rare on different lobes; tips of the central lobes often capitate sorediose, often spreading down the margins; surface minutely white reticulate due to absence of brownish granules in the outer portion of the upper cortex, and in older portions cracking along the reticulations; underside black and nude in the center, shading to Dresden brown on the tips of the ultimate lobules, peripheral lobes rhizinose, rhizinae 40–70 μ in diameter, dense, much branched, short, formed of fascicles of medullary hyphae, corticate from cells of the lower cortex; upper cortex 13–16 μ thick, of fastigiate pseudoparenchyma, cells thinwalled, 5–6 μ in diameter, the outer 10 μ heavily nubilated with brownish granules; algal layer 20 μ thick, of discrete colonies of *Trebouxia*, about 20 μ in diameter, in a nearly continuous layer, cells 5–6 μ in diameter; medulla K–, C–, KC–, about 100 μ thick, of closely woven, longitudinal hyphae, 3–4 μ in diameter, with moderately thick walls, nearly all heavily nubilated with hyaline granules which obscure structure; lower cortex black, 7 μ thick, of a single layer of closely septate, longitudinal hyphae.

Apothecia few, urceolate, imperforate at first, becoming perforate, 5–6 mm. in diameter, constricted at the base but not stipitate, exciple smooth, finally somewhat rugose, margin crenate and lobulate incised, here and there sorediose; disc auburn; amphithecial cortex 30–38 μ thick above, expanding to 50–55 μ thick below, structure similar to the thalline cortex but cells larger, 7–10 μ in diameter; algal layer under the parathecium 27–38 μ thick, of discrete colonies; parathecium yellow ochraceous (combined parthecium and hypothecium 48–60 μ thick); thecium 50–70 μ tall; paraphyses filiform, 2 μ in diameter, tips clavate 3–4 μ in diameter in the brownish epithecial gel 7 μ thick; asci broadly clavate, 28–40 × 19–22 μ, thickwalled, 8-spored; ascospores broadly ellipsoid, 9–15 × 6–8.5 μ, episporescarcely 1 μ thick.

Spermogonia 130–150 μ in diameter, wall thickened and blackened about the ostiole; spermatiophores little branched, up to 67 μ long, scarcely 2 μ in diameter; spermatia bacilliform, straight, 7–11 × 0.5–0.6 μ.

The description of the apothecia and spermogonia are translated and condensed from the original description as the apothecia in our single fertile specimen (*Dale L48* p. p. min.) are very young. The youngest stage seen is spherical, about 65 μ in diameter, consisting of an outer algal layer about 10 μ thick, continuous with the thalline algal layer, the ascogonium, a coil 40 μ long, 13 μ in diameter, very deeply staining, closely septate into nearly isodiametric cells, prolonged upward into the thalline cortex as a very slender trichogyne, sparingly septate and scarcely staining. In a slightly older stage, young paraphyses have grown upward nearly to the thalline cortex. Both stages are still completely immersed below the thalline cortex.

Our specimens agree well with the original description except for the K reaction of the medulla. Our specimens have the thallus and medulla K–, while the original description calls for the medulla K yellow, here and there rufescent. Most of our specimens were growing at higher altitudes.

KENYA: Kinango, 2250 m., growing over bryophytes on forest trees, *Allen Turner 6388*, ex Coryndon Mus. at Kew.

UGANDA: Karamoja, Timu forest, 2100 m., truncicole, *A. S. Thomas 3224*; Kigezi, Mafuga, 2415 m., saxicole, *I. R. Dale L46* p. p. min.; Naiguru ridge, 2250–2580 m., corticole, *I. R. Dale L48* p. p. min.; 2415 m., growing over hepatics on bark, *I. R. Dale L49* p. p. min.; all at Kew.

NYASSALAND: Mlanje District, Luchenya Plateau, Mt. Mlanje 2100 m., on exposed tree trunk, *L. J. Brass 16474*, Vernay Nyasaland Exp. in Dodge Herb.

NORTHERN RHODESIA: Abercorn, growing over *Cryptorchis* roots on *Brachystegia taxifolia*, in dense shade of crown, *A. A. Bullock 2104* p. p. min., International Red Locust Control Service, at Kew.

?ANGOLA: Amboim, Cuanza Sul. 1000 m., on dead tree, *J. Gossweiler 9991* p. p. min. very immature, at Kew.

PARMELIA (HYPOTRACHYNA) **decorata** (Hue) Dodge, comb. nov.

Parmelia mutata f. *decorata* Hue, Nouv. Ach. Mus. [Paris] IV. 1:172. 1899.

Type: Reunion, *Rodrigues*; Madagascar, Betsileo, *Besson*, com. Renauld.

Thallus 14 cm. in diameter, ashy glaucescent becoming olive buff on peripheral lobes and pinkish buff on central portions, irregularly dichotomous, peripheral lobes 20 mm. long, 10 mm. wide, subimbricate, subpinnately lobulate with rounded sinuses, lobules 2–3 mm. wide and long, tips truncate to rounded, sparingly ciliate, cilia 0.5 mm. long (rhizinae bend outward and show at the margin, thus appearing closely ciliate at low magnifications); central lobes with smaller lobules, capitate sorediate, soralia subspherical, 1 mm. in diameter, very rarely confluent; surface minutely white reticulate, K yellow; underside black with shining chestnut margins, rhizinae short, close, becoming papillae at the margins; upper cortex 16–18 μ thick, of fastigiate pseudoparenchyma, cells thickwalled, rounded, 5–6 μ in diameter, the outer 10 μ nubilated with brownish granules and appearing greenish brown in thick sections, interrupted by cracks 10 μ wide through the algal layer, covered by an amorphous layer 2–3 μ thick; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter, the lower half heavily nubilated with brownish granules; medulla K yellow reddening, C–, KC yellow then very slowly reddening, 55 μ thick, of closely woven, longitudinal, thickwalled hyphae 2–3 μ in diameter, very heavily nubilated with grayish brown granules; lower cortex 15 μ thick, black, pseudoparenchymatous from longitudinal thickwalled hyphae; rhizinae 35 μ in diameter formed by outgrowth of the hyphae of the lower cortex.

Apothecia short stipitate, 4–7 mm. in diameter, margin entire to very minutely crenulate, inrolled, exciple smooth, finally slightly sorediose, disc concave, orange rufous to Sanford brown; amphithecial cortex 65 μ thick below, thinning to 30 μ thick at the margin, fastigiate, very highly gelified; algal layer 15 μ thick, with some colonies pushing up into the cortex for 30 μ above the lower surface of the cortex; algal layer under the parathecium 20 μ thick, continuous, cells somewhat less crowded than in the thalline layer; parathecium 20–25 μ thick, fastigiate, of

very thickwalled gelified hyphae; hypothecium 60 μ thick, of very thickwalled and gelified, periclinal hyphae, a little thinner-walled and less gelified in the upper 10–15 μ; thecium 75–80 μ tall; paraphyses 1.5–2 μ in diameter, septate, tips not or very slightly thickened, ending 9–12 μ below the surface of the hyaline epithecial gel; asci 65 $\times$ 15 μ, wall 3 μ thick, tip slightly thicker, protoplast mamillate, 8-spored; ascospores 14–17 $\times$ 7–9 (–12) μ, with a moderately thick epispore.

Spermogonia immersed in the peripheral lobes, oblately spheroidal, 80 μ tall, 120 μ in diameter, neck 30 μ long; wall 10 μ thick; spermatiophores 30 μ long, about 2 μ in diameter, septate; spermatia bacilliform, about 6 $\times$ 1 μ.

MAURITIUS: *Robillard,* sub *P. perlata* v. *olivetorum* Nyl. det. Müll. Arg. at Farlow Herb.

MADAGASCAR: East Imerina, Andrangolaoka, *J. M. Hildebrandt,* Nov. 1880, sub *P. proboscidea* v. *corallina* Müll. Arg. ex hb. Sbarbaro at Farlow Herb.

CAPE OF GOOD HOPE: Table Mt., *A. E. Eaton,* Venus Transit Exp.; Kentani District, 320 m., on *Acacia horrida, Alice Pegler,* fragment; both at Kew.

PARMELIA (HYPOTRACHYNA) RETERIMULOSA Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:520. 1926.

Type: South Africa, Natal, Drackenberg, Van Reenens Pass, 1700–1750 m., saxicole, ***Brunnthaler.***

Thallus glaucous green (deep olive buff to wood brown in our specimens), 7 cm. in diameter, peripheral lobes 20 mm. long, 10 mm. wide, branching irregular, dissected into lobules 3–4 mm. wide, 2–4 mm. long, sinuses rounded to excised, narrowly black margined, cilia short 0.5–1 mm. long; surface minutely rimulose reticulate in the central portions, less so on the marginal lobules; soredia capitate on margins of central lobes, distant to close and subconfluent; underside black, shading to bister or darker at the margins, densely rhizinose, rhizinae branched, shorter and papilliform at the margins of the lobules; upper cortex 16–20 μ thick, fastigiate, hyphae 4 μ in diameter, lumina about 1 μ; algal layer 15–20 μ thick, of close discrete colonies of *Trebouxia,* 15–20 μ in diameter, cells 6–7 μ; medulla K yellow, then irregularly rufescent, C–, KC–, 55–65 μ thick, of closely woven, thickwalled, longitudinal hyphae, 3 μ in diameter, a little looser at the bottoms of the cracks through the upper cortex and algal layer, and just above the lower cortex; lower cortex black, 16–23 μ thick, of fastigiate pseudoparenchyma, growing out as rhizinae 30–35 μ in diameter.

Apothecia rare, not pedicellate, urceolate becoming nearly plane, up to 12 mm. in diameter, exciple smooth becoming reticulate rugose, margin thin, involute; disc chestnut; amphithecial cortex about 30 μ thick above to 40–48 μ thick below, fastigiate of thickwalled hyphae up to 8–9 μ in diameter; algal layer about 10 μ thick of very scattered colonies; algal layer under the parathecium 22–25 μ thick, nearly continuous, cells 11–17 μ in diameter (38–40 μ fide Steiner & Zahlbr.); parathecium 30 μ thick, similar in structure to the amphithecial cortex; hypothecium 15–20 μ thick, of very slender, periclinal hyphae; thecium 40–57 μ tall; paraphyses 1.5–2 μ in diameter, branched above the asci, tips clavate to capitate in the brownish epithecial gel; asci broadly clavate, 38–50 $\times$ 15–19 μ, 8-spored, wall thickened at the tip; ascospores ellipsoid, 9.5–14 $\times$ 6.5–9 μ, epispore scarcely 1 μ thick.

The characters of the apothecia and paraphyses above are translated from the original description. Our specimens were sterile except for a loose fragment 1 mm. square. Such characters as were observable agree closely with the original description except for a thinner algal layer under the parathecium with somewhat smaller cells. Our specimens are often moribund and discolored from too slow drying, i.e. the surface is slightly mouldy in places. Our Tanganyika and Uganda specimens have the thallus and medulla K–, the others K yellow becoming irregularly rufescent.

CONGO: Kahusi, 2700 m., corticole, *F. L. Hendrickx 4303, 4305, 4316, 4322* in E. African Herb.

KENYA: buffalo country south of Navossaro, 1610–2250 m., on orchid roots, *Anita Grosvenor Curtis 700d*, in Dodge Herb.; northeast side of Mt. Elgon, 2575 m., *A. Burnet L31*, in Makerere Coll. Herb.

UGANDA: Kigezi, Echuya, 2580 m., saxicole, *I. R. Dale L59* p. p. min.; Mafuga, 2415 m., *I. R. Dale L50* p. p. min., moribund fragments; Naiguru Ridge, 2250–2580 m., corticole, *I. R. Dale L48a*, all at Kew.

TANGANYIKA: without locality, tangled with hepatics, *Braun* ex B. L. Institut Amani 8602, in E. African Herb.; E. Usambara, Bomale near Amani on quinine trees in comparatively dry situations, growing over mosses, *R. E. Moreau & William Moreau*, at Kew, juvenile.

NYASALAND: Mlanje District, Lucheniya Plateau, Mt. Mlanje, 1860 m. on exposed branches of trees in rain forest, *L. J. Brass 16452*, Vernay Nyasaland Exp., in Dodge Herb.

CAPE OF GOOD HOPE: without locality, *C. H. Hitchcock*, in Tuckerman herb. sub *P. perforata* "lobi dein crenato-lobulati, subtus hispidi! CaCl non tingitur, K flavescit nec CaCl rubet nisi sero" at Farlow Herb.; Swellendam, [*Drège*] 94, Mars 1827, moribund fragment at Kew.

PARMELIA (HYPOTRACHYNA) **ornata** (Hue) Dodge, comb. nov.

Parmelia acanthifolia f. *ornata* Hue, Nouv. Arch. Mus. [Paris] IV. 1:171. 1899.

Type: not designated. Réunion, Salazia, corticole, *Rodrigues*; Mauritius, *Rodrigues.*

Thallus 10–15 cm. in diameter, deep olive buff, lobes 10–15 mm. wide, very irregularly and deeply crenate with deep excised sinuses, forming large lobules 2 mm. wide at the base, 5 mm. wide above, about 10 mm. long, and much smaller lobules bearing soralia, margins smooth, irregularly short ciliate, cilia 0.5 (–1) mm. long; upper surface deeply rimose areolate in older portions, not in younger; soralia capitate, spherical, sessile on the margins or on small lobules up to 1 mm. long, 0.5–1 mm. in diameter, soredia coarsely granular; underside black to the margin or sometimes chestnut brown, completely covered by rhizinae up to 1 mm. long, simple, or occasionally dichotomous; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 6 μ in diameter, thickwalled, conglutinate, interrupted by cracks penetrating the algal layer; algal layer 20 μ thick, continuous, cells 6–8 μ in diameter, often in columns between vertical medullary hyphae but not filamentous; medulla K yellow, then deep orange (finally blood red fide Hue), C–, KC–, 75 μ thick, of closely woven, longitudinal hyphae, 2–3 μ in diameter, very heavily nubilated with grayish granules, tearing easily from the lower cortex on sectioning; lower cortex 15 (–25) μ thick, black, pseudoparenchymatous from longitudinal hyphae; rhizinae 50–55 μ in diameter, branched.

Apothecia stipitate, stipe up to 3 mm. long, about 1 mm. in diameter, remaining

cupulate, 2–5 (–10) mm. in diameter, margin entire, exciple minutely white punctate and reticulate at first, then margin and upper part of the exciple developing spherical soralia in an almost continuous crust, disc very concave, tawny; amphithecial cortex 40–50 μ thick, similar in structure to the thalline cortex but cells somewhat larger, not sharply differentiated from the algal layer below as the algal cells push up between the crushed cortical hyphae to form the soredia; algal layer under the parathecium 15 μ thick, of colonies of *Trebouxia,* forming a nearly continuous layer; parathecium 30 μ thick, of fastigiate pseudoparenchyma, hyphae very thickwalled, conglutinate, protoplasts spherical, 1–2 μ in diameter; hypothecium of very thickwalled periclinal hyphae, very closely woven, about 2 μ in diameter; thecium 80–90 μ tall; paraphyses about twice dichotomous above the asci, tips clavate, up to 4–5 μ in diameter, ending within the brownish epithecial gel; asci clavate, 60 × 20 μ, wall 3 μ thick when young, tips 6 μ thick, 8-spored; ascospores ellipsoid, (13–) 15 × 8–9 (–10) μ, with a moderately thick epispore.

MAURITIUS: without locality, *Dr. Wight* in Taylor Herb., glued to sheet with *P. cristifera* Taylor, recognized as different by Taylor but not named, at Farlow Herb.; *W. Bojer,* Herb. Hookerianum at Kew.

CAPE OF GOOD HOPE: without locality, *C. H. Hitchcock* sub *P. perforata* in Tuckerman Herb. at Farlow Herb.

PARMELIA (HYPOTRACHYNA) **Sanctae-Helenae** Dodge, sp. nov.

Type: St. Helena, *J. C. Meliss 9,* at Kew.

Thallus ad 6 cm. diametro, brunneus, apicibus obscure olivaceo-alutaceus, lobis irregulariter dichotomis, centralibus 10 × 3 mm., subpinnatis, lobulis ultimis 1 × 0.5 mm., apicibus rotundatis subtruncatisve, sinibus rotundatis; sorediis capitatis, granulosis, in lobulis ultimis; lobis periphericis 20 × 1.5 mm., lobulis ultimis 3 × 1 mm., truncatis subretusisve, esorediosis; ciliatus, cilia 1–2.5 mm. in lobis centralibus, 0.5 mm. in lobis periphericis, superne rimoso-areolatus, K subflavescens, C–, KC flavescens; inferne niger, reticulatim rugulosus, rhizinis brevibus, dichotomis; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 3–4 μ diametro; stratum algarum 15 μ crassitudine, coloniis discretis *Trebouxiae,* cellulis 3–4 μ diametro, granulis griseis nubilatis; medulla K flavens dein rubescens, C–, KC flavens dein rubescens, 20–25 μ crassitudine, hyphis longitudinalibus nubilatis, dense contextis; cortex inferior 12–13 μ crassitudine, fastigiatus, gelifactus.

Apothecia 5–6 mm. diametro, urceolata, marginibus involutis, subcrenulatis, excipulo laevi, albo-reticulato dein soredioso, disco castaneo, concavo, imperforato; cortex amphithecialis 30 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 7–8 μ diametro, granulis griseis nubilatis; stratum algarum 30 μ crassitudine, subcontinuum, cellulis 6 μ diametro; medulla densa, granulis griseo-brunneis nubilata; stratum algarum sub parathecio 20 μ crassitudine, continuum; parathecium 15 μ crassitudine, pseudoparenchymatice fastigiatum, cellulis 2.5 μ diametro; hypothecium 20 μ crassitudine, hyphis tenuibus, periclinalibus; thecium 40 μ altitudine; paraphyses septatae, semel bisve dichotomae super ascos, ramis moniliformibus, apicibus non incrassatis; asci cylindrici dein late clavati, 30 × 12 μ; ascosporae octonae, late ellipsoideae, 11 × 6 μ, episporio tenui.

Thallus up to 6 cm. in diameter, wood brown, shading toward deep olive buff at the tips, lobes irregularly dichotomous, central lobes 3 mm. wide, 10 mm. long, with short internodes, appearing subpinnate, ultimate lobules about 0.5 mm. wide, 1 mm. long, tips rounded to subtruncate, sinuses rounded; peripheral lobes 1.5 mm. wide, 20 mm. long, divaricately dichotomous, internodes 2–3 mm. long, ultimate lobules about 1 mm. wide, 3 mm. long, tips truncate to slightly retuse, all closely ciliate, cilia 1–2.5 mm. long on central lobes, only about 0.5 mm. long on peripheral lobes; soralia capitate, on tips of the lobules on the central lobes, spreading to the adjacent upper surface, absent on the peripheral lobes, soredia granular; upper surface rimose areolate on central lobes, K yellowing slightly, C bleached to white, KC clearer yellow; underside black, reticulate rugulose, densely rhizinose in the center, sparsely so towards the tips of the lobes, rhizinae short, dichotomous; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 2–3 μ in diameter, the upper half greenish brown; algal layer 15 μ thick, of small discrete colonies of *Trebouxia*, cells 3–4 μ in diameter, very heavily nubilated with grayish granules; medulla K yellow then red, C–, KC yellow then red, 20–25 μ thick, of densely woven longitudinal hyphae, heavily nubilated with grayish-brown granules; lower cortex 12–13 μ thick, fastigiate, highly gelified.

Apothecia 5–6 mm. in diameter, urceolate, margin inrolled, slightly crenulate, exciple smooth, white reticulate, becoming sorediate, disc deeply concave, imperforate, chestnut; amphithecial cortex 30 μ thick, fastigiate of thinwalled pseudoparenchyma, cells 7–8 μ in diameter, nubilated with grayish granules, interrupted where columns of algal cells push out to the surface to form soredia; algal layer 30 μ thick, subcontinuous, cells 6 μ in diameter; medulla dense, heavily nubilated with grayish brown granules; algal layer under the parathecium 20 μ thick, continuous, cells densely packed; parathecium 15 μ thick, gelified, of fastigiate pseudoparenchyma, lumina 25 μ in diameter; hypothecium 20 μ thick, of periclinal, slender hyphae, deeply staining, thecium 40 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches moniliform, tips not thickened, ending 8 μ below the surface of the pale brownish epithecial gel; asci cylindric, becoming broadly clavate, 30 $\times$ 12 μ, 8-spored; ascospores broadly ellipsoid, 11 $\times$ 6 μ with a thin epispore.

The medullar reactions are somewhat variable. *Burchell 237* has the medulla KC–, *Borden 104* has the medulla KC yellow fading, *Menzies* has the medulla now K–, C–, KC–, although Tuckerman states on his label for one thallus, "K rubescit, C–," for the other "K–, C subrubescit." *Burchell 237* states on the label C+, presumably pink but it is now C–. Only field work can determine whether these are ecologic variants.

A third plant glued to the sheet with the other Menzies specimens has broader, more rounded lobes, 30 mm. broad, 15 mm. long, with some small digitate lobules, many lobes capitate sorediate becoming confluent. It agrees with the other two in microscopic characters.

ST. HELENA: *J. C. Melliss 9*, type, *10* p. p. majore, *25*, all corticole, *85*, saxicole; *Burchell 227, 237*; all at Kew; *Menzies* ex hb. Menzies sub *P. perlata* in Tuckerman Herb. on sheet with *P. laevigata* but not so labeled in Farlow Herb.

FERNANDO PO: Santa Isabel Peak, 2575 m., on stones, *Gustavo Mann* at Kew.
ASCENSION ISLAND: Green Mountain on dead wood, *G. Borden 104* at Kew.
TRISTAN DA CUNHA: Challenger Exp. 3 collections; *John McGillivray*, Voy. Herald; all at Kew.

PARMELIA (HYPOTRACHYNA) Lythgoeana Dodge, sp. nov.

Parmelia tiliacea v. *hypoleuca* Müll. Arg., Bot. Jahrb. [Engler] 20:257. 1894, non *P. hypoleuca* Muhlenberg.

Type: Ethiopia, Chokke Mts., 10° 40′ N., 37° 45′ E., wood behind Camp I, 3220 m., ramulicole, *J. N. Lythgoe 17a*, C.B.E.E. at Kew. *P. tiliacea* v. *hypoleuca* Müll. Arg. was based on Tanganyika, Usambara, corticole, *Holst 787* p. p.

Thallus ca. 3 cm. longitudine, 2 cm. latitudine, ramulos involvens, dilute glaucus, lobis peripheric is ca. 5 mm. longitudine, 10 mm. latitudine, semiorbicularibus, marginibus crenatis, sinibus acutis, raro rotundatis, centro rubrugulosus, marginibus eciliatis, laevibus; inferne dilute alutaceus, rhizinis confertis, obscuris, brevibus, tenuibus; cortex superior 6 μ crassitudine, cellulis isodiametricis, 3 μ diametro, pachydermeis, subirregulariter dispositis; stratum algarum 65 μ crassitudine, continuum, cellulis 6–7 μ diametro; medulla K–, C–, KC–, 90–105 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, luminibus 2 μ; cortex inferior pallidus, non bene evolutus.

Apothecia 2 mm. diametro, substipitata, marginibus inflexis, subcrenulatis, excipulo laevi, subnitido, disco concavo, brunneo; cortex amphithecialis 55 μ crassitudine, fastigiatus gelifactusque, hyphis aliquando dichotomis, anastomosantibusque, luminibus ca. 1 μ diametro, 3–4 μ longitudine; stratum algarum coloniis *Trebouxiae* ad 30 μ diametro, discretis sparsisque et cellulis singulis; stratum algarum sub parathecio continuum, 25–30 μ crassitudine; parathecium 30–40 μ crassitudine, pseudoparenchymatice fastigiatus, protoplastis subsphaericis, 2.5–3 μ diametro; hypothecium 30 μ crassitudine, hyphis tenuibus, septatis, periclinalibus; thecium 60 μ altitudine; paraphyses septatae, super ascos semel bisve dichotomae, apicibus non incrassatis; asci clavati, ca. 30 × 8 μ, apicibus subincrassatis; ascosporae ellipsoideae, 8 × 5 μ, (immaturae), episporio crasso.

Thallus about 3 cm. long, 2 cm. wide, closely wrapped around twigs, very pale glaucous, peripheral lobes about 5 mm. long, 10 mm. wide, semicircular, margins crenate, smooth, eciliate, sinuses acute, rarely slightly rounded, rarely very slightly lobulate, center somewhat rugulose, without isidia or soredia; underside pale buff, densely covered with short, dark rhizinae, branched at the tips; cortex scarcely differentiated, about 6 μ thick, of isodiametric cells 3 μ in diameter, thickwalled, somewhat irregularly arranged; algal layer 65 μ thick, continuous, of very closely packed cells 6–7 μ in diameter, with an occasional cell deeper in the medulla; medulla K–, C–, KC–, 90–105 μ thick, of very closely woven predominantly longitudinal hyphae 3 μ in diameter, lumen 2 μ; lower cortex scarcely differentiated except the outermost hyphae are more closely septate into nearly isodiametric cells; rhizinae 35 μ in diameter, formed from a fascicle of medullary hyphae growing downward, the outer hyphae very pale brown, the rest hyaline.

Apothecia 2 mm. in diameter, cupulate, substipitate, margins inflexed, slightly

crenulate, exciple smooth, subnitid, disc concave, burnt sienna; amphithecial cortex 55 μ thick, fastigiate, gelified, hyphae sometimes dichotomous and anastomosing, lumina 1 μ in diameter, 3–4 μ long; algal layer of very scattered colonies up to 30 μ in diameter with many single cells; medulla of closely woven periclinal hyphae; algal layer under the parathecium 25–30 μ thick, continuous, with occasional cells or small colonies pushing up into the lower part of the parathecium; parathecium 30–40 μ thick, of fastigiate pseudoparenchyma, protoplasts subspherical, 2.5–3 μ in diameter; hypothecium 30 μ thick, of slender, septate hyphae, the lower half deeply staining, the upper half scarcely so; thecium 60 μ tall; paraphyses simple or once or twice dichotomous, septate, tips not thickened, ending about 5 μ below the surface of the brownish epithecial gel; asci clavate, about 30 $\times$ 10 μ, 8-spored, tips only slightly thickened; ascospores ellipsoid, about 8 $\times$ 5 μ, with a moderately thick epispore (perhaps still immature, ascospores still in the ascus and only a few asci seen).

ETHIOPIA: Chokke Mts., 10° 40′ N., 37° 45′ E., north of Debra Marcos, wood behind Camp I, 3220 m., ramulicole, *J. N. Lythgoe 17a*, type *17b*, C.B.E.E., at Kew.

PARMELIA (HYPOTRACHYNA) **Menziesii** Dodge, sp. nov.

Type: Cape of Good Hope, *A. Menzies* sub *P. perforata* in Tuckerman Herb. at Farlow Herb.

Thallus 6 cm. diametro, cinnamomeo-alutaceus, K flavescens, lobis centralibus 10 mm. latitudine, pinnatim ramosis, sinibus rotundatis, peripheris rotundatis, 5 mm. longitudine, 10 mm. latitudine, dissectis, lobulis 1 $\times$ 1 mm., apicibus truncatis; superficie convexo, rimoso-areolato, eciliatus; inferne centro nigro, marginibus obscure castaneis, rhizinis longis, tenuibus; cortex superior 25 μ crassitudine, fastigiatus, cellulis 6 $\times$ 4 μ, conglutinatis, nubilatis; stratum algarum 20 μ crassitudine, coloniis discretis, confertis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K flavescens dein rufescens, C–, KC– aut evanescenter flavidula, 50 μ crassitudine, hyphis longitudinalibus, granulis griseis dense nubilatis, conferte contextis; cortex inferior niger, 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis subsphaericis, 6–7 μ diametro, conglutinatis.

Apothecia urceolata, stipitata, 4–5 mm. diametro, margine minute crenulato, excipulo rimoso-areolato, disco rufo-aurantiaco subbrunneove; cortex amphithecialis 60 μ crassitudine, fastigiatus, gelifactus; stratum algarum 15 μ crassitudine, continuum; stratum algarum sub parathecio 40 μ crassitudine, continuum, granulis brunneis nubilatum; parathecium 30 μ crassitudine, fastigiatus; hypothecium 30 μ crassitudine, hyphis periclinalibus tenuibus contextum; thecium 70 μ altitudine; paraphyses tenues, super ascos dichotomae, apicibus non incrassatis; asci ellipsoidei, ca. 50 $\times$ 20 μ, pachydermei juventute; ascosporae octonae, ellipsoideae, 18–19.5 $\times$ 9 μ, episporio tenui.

Spermogonia oblate sphaeroidea, 130–160 μ diametro, 115 μ altitudine; perifulcrum 13 μ crassitudine, non bene distinctum; spermatiophorae septatae, non ramosae, 90 $\times$ 1 μ; spermatia laterales ad septos, 5–6 $\times$ 1 μ.

Thallus at least 6 cm. in diameter, probably larger, clay color to cinnamon buff (1957), K yellow, C bleached to white, lobes about 10 mm. wide below, pinnately branched with rounded sinuses, narrowing to about 2 mm. below the peripheral

lobe which is rounded, 5 mm. long, 10 mm. broad, dissected into peripheral lobules about 1 mm. long and wide, tips truncate, sinuses 1 mm. wide; surface convex, deeply rimose areolate; eciliate although rhizinae often project beyond the margin, giving the appearance of cilia under low magnifications, not isidiose nor sorediose; underside black with dark chestnut margins; rhizinae long, slender in the center, papillate to the margin of some lobes, nude and reticulate rugulose at the margins of other lobes; upper cortex 25 μ thick, fastigiate, cells conglutinate about 6 $\times$ 4 μ, nubilated with pale brownish granules in a greenish brown gel; algal layer about 20 μ thick, of discrete, close colonies of *Trebouxia* in a nearly continuous layer; medulla K yellow rufescent, fading to yellow, C–, KC faint yellow soon fading, 50 μ thick, of closely woven longitudinal hyphae, heavily nubilated with grayish granules except in the lower 10 μ; lower cortex black, 20 μ thick, of fastigiate pseudoparenchyma, cells subspherical, 6–7 μ in diameter, conglutinate.

Apothecia urceolate, short stipitate, 4–5 mm. in diameter, margin minutely crenulate, exciple rimose areolate, disc orange rufous to Sanford's brown; amphithecial cortex 60 μ thick, fastigiate, gelified; algal layer 15 μ thick, continuous; algal layer under the parathecium 40 μ thick, continuous, cells more closely packed above, very heavily nubilated with brownish granules; parathecium 30 μ thick, fastigiate, gelified; hypothecium 30 μ thick, of slender, periclinal hyphae, moderately closely woven, in a gel; thecium 70 μ tall; paraphyses slender, dichotomous above, tips not thickened, ending about 7 μ below the surface of the hyaline epithecial gel; asci ellipsoid, about 50 $\times$ 20 μ, thickwalled when young, thinning at maturity, 8-spored; ascospores ellipsoidal, 18–19.5 $\times$ 9 μ, with a relatively thin epispore.

Spermogonia oblately spheroidal, 130–160 μ in diameter, 115 μ tall, wall slightly brownish, 13 μ thick, otherwise not differentiated from medullary hyphae; spermatiophores septate, unbranched, 90 $\times$ 1 μ; spermatia bacilliform, 5–6 $\times$ 1 μ, borne laterally at the septa.

CAPE OF GOOD HOPE: *Menzies*, sub *P. perforata* in Tuckerman Herb., at Farlow Herb.

PARMELIA (HYPOTRACHYNA) COILOCARPA Stirton, Scot. Naturalist 4:202. 1877-8.

Type: Fernando Po, ramulicole, *G. Thomson.*

Thallus about 6 cm. in diameter, pallid neutral gray to almost white, peripheral lobes imbricate, about 2.5 mm. long, 1–2 mm. wide, subpinnately dichotomous, sinuses rounded, ultimate lobules 1–1.5 mm. long, up to 1 mm. wide, tips truncate or slightly rounded; surface smooth, shining, narrowly black margined, rather closely short ciliate, cilia 0.5 mm. long; underside black, shining, auburn on the lobules, densely rhizinose; rhizinae short, simple, densely branched at the tips to form minute holdfasts when in contact with the bark; upper cortex 40 μ thick, fastigiate, of hyphae predominantly periclinal just above the algal layer, sending up vertical branches, conglutinate, dichotomous in the middle, branches moniliform, cells 5–6 μ in diameter, heavily nubilated with brownish granules; algal layer 20 μ thick, continuous, cells 5–6 μ in diameter; medulla K yellow then red, C–, KC–, 80 μ thick, of closely woven longitudinal hyphae, heavily nubilated with grayish

granules, more loosely woven next the lower cortex; lower cortex 15 μ thick, dark brown, of fastigiate pseudoparenchyma, cells 4–5 μ in diameter with moderately thick walls; rhizinae 55 μ in diameter, formed by outgrowth of cells of lower cortex.

Apothecia 7–12 mm. in diameter, margin incurved, entire or nearly so, exciple foveolate impressed; ascospores 24–34 $\times$ 12–17 μ. Spermatia nearly cylindric, straight, 5–5.8 $\times$ 0.65 –0.8 μ.

Our specimen is sterile and the description of the apothecia is translated from Stirton. We have referred our plant here on the basis of its biochemical reactions as Stirton's description of the thallus is inadequate for certain identification.

GUINÉE FRANÇAISE: Macenta, 645–805 m., on bare rock at top of hill, *J. T. Baldwin 9849a*, at Kew.

PARMELIA (HYPOTRACHYNA) OWANIANA Stirton, Trans. Glasgow Soc. Field Nat. **5**:213. 1877; fuller description based on type by Gyelnik, Ann. Mus. Nat. Hungar. Bot. **31**:33. 1938.

Type: Cape of Good Hope, Somerset East, *P. MacOwan*.

Thallus at least 3–4 cm. in diameter, between deep olive buff and avellaneous, peripheral lobes about 15 mm. long, 2–8 mm. wide, imbricate, irregularly dichotomous, tips sometimes rounded, 8 mm. in diameter, margins crenate with rounded sinuses and very rare cilia 0.2–0.4 mm. long, central lobes smaller, sometimes lacerate and subsidiose, surface white reticulate and minutely rimulose areolate, becoming minutely subscrobiculate toward the center, rarely somewhat verrucose, the verrucae elongating and becoming soredioid; underside black, densely rhizinose, margins of tips of lobes chestnut with black papillae or nude, shining, minutely reticulate rugulose in the outer 2 mm.; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells relatively thinwalled, apparently not gelified as algal cells push up between the cortical cells; algal layer 15 μ thick, nearly continuous, cells up to 8 μ in diameter; medulla K yellow, then orange red, C–, KC– [Gyelnik l.c. states: KC rubescens], 55 μ thick, loosely woven, of predominantly longitudinal hyphae, about 3 μ in diameter, rather thinwalled; lower cortex 8–11 μ thick, brown, of rather thinwalled fastigiate pseudoparenchyma, becoming somewhat thinner on the margin, of longitudinal hyphae with isodiametric cells; rhizinae 40 μ in diameter, formed from the outgrowth of hyphae of the lower cortex.

Apothecia (3–) 5 (–9) mm. in diameter, margin thin, subcrenate, exciple rugose-venose to subfoveolate; disc fusco-rufous; ascospores 12–14 $\times$ 8–10 μ.

Although sterile, our specimen agrees with Stirton's and Gyelnik's description of the type except for the reaction with KC. The species is somewhat intermediate between sect. *Hypotrachyna* and subg. *Amphigymnia*.

TRISTAN DA CUNHA: Inaccessible Island, Voy. Challenger, at Kew.

PARMELIA (HYPOTRACHYNA) **angolensis** (Vainio) Bijl, Ann. Univ. Stellenbosch A **9**:3:13. 1931.*

Parmelia gracilescens v. *angolensis* Vainio, Cat. Welwitsch African Pl. **2**:401. 1901.

* Technically Bijl did not make a formal new combination here, as he neither cited the name-bringing synonym nor described the taxon. So far as I can discover, the formal combination is made here for the first time.

Type: Angola, Huila, Serra da Chela, 1225–1775 m., ramulicole, *Welwitsch 30* p. p.; Morro de Lopollo, *Welwitsch 31*, fertile.

Thallus about 5 cm. long, 2 cm. wide, olive buff, lobes about 2 mm. wide below, 20 mm. long, irregularly dichotomous with rounded sinuses, ultimate lobules 3 mm. long, 1.5 mm. wide, tips truncate or nearly so, suberect; underside black, densely rhizinose, rhizinae repeatedly branched in the distal portion; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, protoplasts about 1 μ in diameter, somewhat irregularly arranged, heavily nubilated with brownish granules; algal layer 15 μ thick, continuous or interrupted, colonies of *Trebouxia* 15 μ in diameter, cells 5–8 μ; medulla K–, C–, KC–, 55 μ thick, of predominantly longitudinal hyphae, moderately closely woven, heavily nubilated with hyaline granules; lower cortex 15 μ thick, black, of three layers of nearly isodiametric cells from longitudinal thickwalled hyphae.

Apothecia up to 10 mm. in diameter, cupulate becoming nearly plane, margin entire, inflexed, becoming crenulate, exciple smooth, becoming minutely rugulose, disc chestnut, imperforate; amphithecial cortex 40–55 μ thick, fastigiate, hyphae 7 μ in diameter, protoplasts 1–2 μ in diameter, spaced about 3 μ apart; algal layer 30–40 μ thick, nearly continuous, cells up to 6 μ in diameter; medulla dense, heavily nubilated with grayish granules; algal layer under the parathecium 20 μ thick, continuous; parathecium 20 μ thick, of very small celled fastigiate pseudoparenchyma; hypothecium 15 μ thick, of conglutinate slender, periclinal hyphae; thecium 65 μ tall; paraphyses slender, several times dichotomous above the asci, tips clavate, 5 μ in diameter, nearly reaching the surface of the brownish epithecial gel; asci clavate, about 40 $\times$ 12 μ, tip thickened when young; ascospores short ellipsoid, 10–13 $\times$ 7–8 μ.

Spermogonia immersed, oblate sphaeroidal, 80 μ tall, 170 μ in diameter; wall brown, 10 μ thick, pseudoparenchymatous from periclinal hyphae; spermatiophores about 40 $\times$ 1 μ, unbranched (or branched at the base); spermatia bacilliform, straight, about 6 $\times$ 0.6 μ.

CAMEROONS: Cameroon Mt., collector not given, handwriting resembles that of Gustavo Mann, evidently sent Nylander as no. 7, but his identification not recorded with the specimen, identified as *P. acanthifolia* Pers. by Müller Argau, at Kew.

PARMELIA (HYPOTRACHYNA) DUCALIS Jatta, Ann. di Bot. 6:407. 1908.

Type: Uganda, Mt. Elgon, Bujongolo, valle Bokoku, 3800 m.; Nubitava opposite Kichuchu, 3000 m.; Duroni, west slope of Valle del Laghi, all *Duke Abruzzi.*

Thallus white to pale gull gray, lobes at least 20 $\times$ 6 mm., dichotomous to subpinnate, ultimate lobules 3–4 $\times$ 2 mm.; underside black to margin, very densely rhizinose, rhizinae 1 (–2) mm. long, branched near the tips, extending beyond the margins and appearing as cilia under low magnifications; upper cortex 40 μ thick, of fastigiate pseudoparenchyma, the outer half very heavily nubilated with brown granules; algal layer about 30 μ thick, a nearly continuous layer of colonies of *Trebouxia*, cells 7–8 μ in diameter; medulla K–, C–, KC– to slowly and faintly ferruginous, 165–300 μ thick, of longitudinal, very thickwalled hyphae, very densely woven but not conglutinate, heavily nubilated with white granules; lower

cortex black, 25 μ thick, pseudoparenchymatous, cells irregularly arranged, walls dark brown, moderately thick.

Apothecia sessile, urceolate, 6–15 mm. in diameter, exciple pale, slightly rugulose, disc fuscous, somewhat pruinose, perforate; amphithecial cortex 50–65 μ thick, highly gelified and less clearly fastigiate than the thalline cortex; algal layer 50 μ thick, colonies more discrete; algal layer under the parathecium continuous, 25 μ thick; parathecium 25 μ thick, similar in structure to the amphithecial cortex with somewhat larger lumina; hypothecium 13 μ thick, of very slender periclinal hyphae; thecium 50 μ tall; paraphyses slender, septate, tips slightly clavate, ending in the brownish epithecial gel; asci 8-spored, cylindric clavate, 30–35 $\times$ 9–10 μ; ascospores ellipsoid, 8–9 $\times$ 3–4 μ, with rather thick epispore.

Thomas 167 consists of a single sterile primary lobe, parasitized at the base, separated from other lichens. *Hendrickx 3703* is a more ample collection, but moribund with a single apothecium 7 mm. in diameter, with inrolled margin. The thecium has been eaten away over most of the surface and is regenerating over about half, apparently from the hypothecium.

CONGO: Mt. Kahusi and Kahushwha, on rock, *F. L. Hendrickx 3703*; Mt. Kahusi, 2700 m., on twigs, *F. L. Hendrickx 4314* p. p. min., both in E. African Herb.; north slope of Mt. Karisimbi, Camp Lukumi, muscicole, *Derscheid 2499a*, Exp. Harvard Inst. Trop. Med. 1926-7, at Farlow Herb.

UGANDA: Imatory Mts. between Ibahin 1960 m. and Itibol 2060 m., on rocks, *A. S. Thomas 167* p. p. min. at Kew; Karamoja District, Napak, 2250 m., on rock, *A. S. Thomas 3630* in E. African Herb.; Sese, Towa forest, on rocks in grassland, 1225 m., *A. S. Thomas 3023* p. p. min. at Kew; Kigezi, Naiguru Ridge, 2250–2575 m., corticole, *I. R. Dale L47* p. p. min. a small fragment, at Kew.

NYASALAND: Nchisi Mt., 1400 m., on dry rocks in *Brachystegia* woodland, *L. J. Brass 16919*, Vernay Nyasaland Exp. in Dodge Herb.

PARMELIA (HYPOTRACHYNA) **kahusiensis** Dodge, sp. nov.

Type: Congo, Mt. Kahusi, 2700 m., on twigs and small branches, *F. L. Hendrickx 4300*, in East African Herb.

Thallus 4–6 cm. diametro, pallide olivaceo-alutaceus, lobis ad 30 $\times$ 5 mm., irregulariter dichotomis subpinnatisve, sinibus excisis, lobulis ultimis ca. 2 mm. longitudine, 2–3 mm. latitudine, apicibus subtruncatis retusisve; infra niger, rhizinis ramosis, densis, 50 μ diametro; cortex superior 13–16 μ crassitudine, pseudoparenchymatice fastigiatus, gelifactus, nubilatus; stratum algarum coloniis discretis *Trebouxiae*, 13–16 μ diametro; medulla K–, C–, KC–, 30–35 μ crassitudine, hyphis longitudinalibus compacte intertextis; cortex inferior 15 μ crassitudine, nigerrimus, pseudoparenchymatice fastigiatus.

Apothecia substipitata, ad 7 mm. diametro, margine integro dein crenato, inflexo, excipulo laevi dein subrugoso, roseo-alutaceo, disco cinnamomeo-alutaceo dein sepiaceo; cortex amphithecialis 26–29 μ crassitudine, fastigiatus, gelifactus; stratum algarum sub cortice non bene evolutum, sub parathecio 50–65 μ crassitudine, continuum; parathecium 25 μ crassitudine, fastigiatum; hypothecium ca. 10 μ crassitudine, hyphis tenuibus periclinalibus; thecium 55 μ altitudine; paraphyses tenues, apicibus non incrassatis; asci late clavati subellipsoideive, 20–23 $\times$ 10 μ; ascosporae octonae, distichae, ellipsoideae, 7 $\times$ 5 μ, episporio crasso.

Thallus pale olive buff, 4–6 cm. in diameter, lobes up to 30 $\times$ 5 mm. closely and subirregularly dichotomous, appearing subpinnate, sinuses excised, ultimate

lobules 2–3 mm. wide, about 2 mm. long, tips subtruncate to retuse; underside black with very dense branched black rhizinae, 50 μ in diameter; upper cortex 13–16 μ thick, gelified and nubilated with brownish granules, apparently of fastigiate pseudoparenchyma, interrupted by minute cracks through the algal layer, 10–12 μ wide; algal layer of discrete colonies of *Trebouxia*, 13–16 μ in diameter; medulla K–, C–, KC–, 30–35 μ thick, of closely woven longitudinal hyphae with small air spaces under the algal colonies; lower cortex 15 μ thick, very black, apparently of fastigiate pseudoparenchyma.

Apothecia substipitate, up to 7 mm. in diameter, margin entire at first becoming crenate, inrolled, exciple smooth, finally slightly rugose, pinkish buff, disc cinnamon buff when young, finally sepia; amphithecial cortex 26–29 μ thick, outer 10 μ brownish, the rest hyaline, fastigiate, highly gelified; algal layer not well developed under the cortex but under the parathecium 50–65 μ thick, continuous, of densely packed cells; parathecium 25 μ thick, fastigiate, gelified; hypothecium about 10 μ thick, of slender, thickwalled periclinal hyphae; thecium 55 μ tall; paraphyses slender, tips not thickened, ending in the thin brownish epithecial gel; asci broadly clavate to subellipsoid, 20–23 $\times$ 10 μ, 8-spored; ascospores distichous, ellipsoid, 7 $\times$ 5 μ, with moderately thick epispore.

Hendrickx 4305 from the type locality may belong here, but the lobes are somewhat narrower and sterile. *Hendrickx 4314* p. p. min. is a moribund fragment.

CONGO: Mt. Kahusi, 2700 m., on twigs and small branches, *F. L. Hendrickx 4300*, type, *4305, 4314* p. p. min. all in E. African Herb.

KENYA: Endabarra, Mau forest, 2350 m., growing over mosses in *Acacia* grove, *P. R. O. Bally B4947* p. p. min. ex Coryndon Memorial Mus., at Kew.

UGANDA: Mt. Elgon, 1290 m., corticole, *W. Small 217* p. p. min.; Karamoja, Mt. Morongole, 2575 m., corticole, *A. S. Thomas 3308* p. p. min.; Bunyoro, Busingoro, 1130 m., on *Poinsettia* bush, *I. R. Dale L51b*; Kigezi, saddle between Muhuvura and Mgahinga, 2900 m., corticole, *I. R. Dale L11c*, fragment; all at Kew.

NYASALAND: Nyika Plateau, 2300 m., on dead branches of *Philippia* trees, *L. J. Brass 17235*, in Dodge Herb.

PARMELIA (HYPOTRACHYNA) **subplumbeata** Dodge, sp. nov.

Type: Congo, Camp Lukumi on south slope of Mt. Karisimbi, 3460 m., growing over mosses, *Derscheid 2504*, Exp. Harvard Inst. Trop. Biol. Med. 1926-27, in Dodge Herb.

Thallus 3 cm. diametro, pallide griseo-olivaceous, lobis 20 $\times$ 6–7 mm., semel vel bis dichotomis, marginibus lobulatis, lobulis ultimis, 2 $\times$ 1 mm., apicibus truncatis, eciliatis, nigromarginatis; inferne niger, marginibus roseo-alutaceis; rhizinae breves, densae, ramosae, nigrae; cortex superior 16 μ crassitudine, fastigiatus, gelifactus; stratum algarum 10 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 4–5 μ diametro, medulla K–, C–, KC flavens dein lente aurantiaca, 30–35 μ crassitudine, hyphis longitudinalibus 3–4 μ diametro, pachydermeis; cortex inferior 20 μ crassitudine, gelifactus, fastigiatus, dimidia parte extera nigrobrunnea.

Apothecia ad 6 mm. diametro, sessilia, basi constricta, marginibus integris, inflexis, excipulo laevi, cinnamomeo-alutaceo, disco subrufo, perforato; cortex amphithecialis 50 μ crassitudine, fastigiatus, gelifactus, hyphis sparsim septatis, luminibus 1 μ diametro; stratum algarum male evolutum; stratum algarum sub

parathecio 20–25 μ crassitudine, subcontinuum; parathecium 16 μ crassitudine, hyalinum, hyphis septatis, fastigiatum; hypothecium ca. 15 μ crassitudine, hyphis tenuibus periclinalibus; thecium 40 μ altitudine; paraphyses tenues, simplices, apicibus non incrassatis; asci clavati dein ellipsoidei, 30 $\times$ 10 μ, pachydermei, apicibus incrassatis; ascosporae octonae, sphaericae, 6 μ diametro, episporio crasso.

Thallus 3 cm. in diameter, light grayish olive, deep olive buff when moistened, lobes 20 $\times$ 6–7 mm., once or twice dichotomous, ultimate lobules about 2 $\times$ 1 mm., tips truncate, eciliate, but rhizinae may show at the margins, narrowly black margined; underside black shading to pinkish buff at the margins, rhizinae short, dense, branched, black upper cortex 16 μ thick, fastigiate, gelified, outer 6 μ brownish; algal layer 10 μ thick, of discrete colonies of *Trebouxia,* cells 4–5 μ in diameter, with an occasional cell deeper in the medulla; medulla K–, C–, KC yellow, slowly orange, 30–35 μ thick, of very closely woven longitudinal hyphae, 3–4 μ in diameter with very slender lumina; lower cortex 20 μ thick, gelified, fastigiate, the outer half very dark brown.

Apothecia up to 6 mm. in diameter, sessile or substipitate, margin entire, inrolled, exciple smooth, cinnamon buff, disc auburn, finally perforate; amphithecial cortex 50 μ thick, fastigiate, hyaline, highly gelified, hyphae rarely septate, lumina about 1 μ in diameter; algal layer represented by an occasional colony of 2–3 cells; algal layer under the parathecium 20–25 μ thick, nearly continuous; parathecium 16 μ thick, fastigiate, hyaline, hyphae more septate than in the amphithecial cortex; hypothecium about 15 μ thick, of very slender periclinal hyphae; thecium 40 μ tall; paraphyses slender, unbranched, tips not thickened, ending near the surface of the brownish epithecial gel 10 μ thick; asci 8-spored, clavate becoming ellipsoidal, wall and tip thickened when young, 30 $\times$ 10 μ; ascospores spherical, 6 μ in diameter, with a moderately thick epispore.

A duplicate of the type was identified by Zahlbruckner as *P. plumbeata* Zahlbr. before publication in Handel-Mazzetti, Symb. Sinicae **3**:189. 1930, but he did not cite the African specimen. Our species differs from *P. plumbeata* in much smaller algae (4–5 μ) in discrete colonies instead of cells 12–16 μ in a continuous layer; apothecia 6 mm. in diameter, disc perforate instead of 3 mm., disc imperforate, and in the medulla KC yellow, slowly orange instead of KC–.

CONGO: Camp Lukumi, on north slope of Mt. Karisimbi, 3460 m., growing over mosses, *Derescheid 2504,* Exp. Harvard Inst. Trop. Biol. Med. 1926-27, in Dodge herb.

PARMELIA (HYPOTRACHYNA) SENSIBILIS Steiner & Zahlbr., Bot. Jahrb. [Engler] **60**:522. 1926.

Type: Kenya, Burra, ramulicole, *Schroeder 285.*

Thallus wrapped around twigs, appressed and imbricate, at least 3.5 $\times$ 1.5 cm., olive buff to pale olive buff, marginal lobes 4–7 mm. long, 2–5 mm. wide, eciliate, crenate to minutely lobulate, sinuses narrow, rounded, irregularly dichotomous, surface smooth, minutely rugulose and rimulose in the center of larger lobes; underside black, densely rhizinose, minutely papillate at the margins; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells moderately thickwalled, rounded, heavily nubilated with brownish granules; algal layers 20 μ thick, continuous, cells 5–6 μ in diameter; medulla K yellow then orange red, C–, KC orange red, 75 μ

thick, of closely woven longitudinal hyphae, 3 μ in diameter, very heavily nubilated with grayish granules, somewhat more loosely woven and less nubilated next the lower cortex; lower cortex 8 μ thick, of fastigiate pseudoparenchyma, protoplasts about 1 μ in diameter.

Apothecia urceolate, up to 3 mm. in diameter, margin entire, inflexed, exciple smooth, disc perforate, buckthorn brown; amphithecial cortex 15 μ thick, of fastigiate pseudoparenchyma; algal layer 30 μ thick, continuous, cells 5–6 μ in diameter; medulla densely nubilated throughout; algal layer under the parathecium 15 μ thick, continuous; parathecium 30 μ thick, fastigiate, gelified, lumina about 1 μ in diameter; hypothecium 20–22 μ thick, of very densely woven, slender, periclinal hyphae; thecium 45 μ tall; paraphyses slender, septate, once dichotomous above the asci, branches moniliform, tips not enlarged, ending 5 μ below the surface of the brownish epithecial gel; asci 8-spored, ellipsoid, 27–30 $\times$ 10–11 μ, tip about 6 μ thick; ascospores broadly ellipsoid, 8–11 $\times$ 6–7 μ, with a thick epispore, subdistichous.

NYASALAND: Cholo Mt. 1200 m., in rain forest, ramulicole, *L. J. Brass 17771*, Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (HYPOTRACHYNA) BRACHYPHYLLA Müll. Arg., Flora 69:256. 1886.

Type: S. Africa, Transvaal, Lydenburg, *Wilms*, com. Lahm.

Thallus about 5 cm. in diameter, citrine drab in the center, shading to deep olive buff at the margins, peripheral lobes 10 mm. long, 15 mm. wide, pinnately branched, main axis 2–3 mm. wide, slightly convex, sinuses rounded, tips truncate or rounded, ultimate lobules 1 mm. long, 1–1.5 mm. wide, eciliate; surface smooth, center somewhat rugose; underside black with dense black rhizinae; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter; algal layer 25 μ thick, of discrete colonies of *Trebouxia*, cells 5–6 μ in diameter, between vertical medullary hyphae; medulla K slowly yellow (ochroleucous), C red above, negative next the lower cortex, KC red above, negative below, 100 μ thick, of loosely woven, thickwalled hyphae, 3 μ in diameter, not nubilated; lower cortex 13 μ thick, deep brown, pseudoparenchymatous from longitudinal hyphae; rhizinae 55 μ in diameter.

Apothecia 4–5 mm. in diameter, urceolate at first becoming nearly plane, margin crenulate, exciple smooth to impressed punctate, disc bay to chestnut; amphithecial cortex 40 μ thick, fastigiate, the upper 15 μ similar to the thalline cortex, but more heavily nubilated with brownish granules and gelified, the rest of dichotomously branched vertical hyphae; algal layer of discrete colonies 20 μ in diameter, dying out below; algal layer under the parathecium 25–40 μ thick, cells 10 μ in diameter in a nearly continuous layer, mostly solitary; parathecium 30 μ thick, of fastigiate pseudoparenchyma, rather thinwalled, protoplasts 3–4 $\times$ 3μ, short ellipsoidal; hypothecium 30 μ thick, of loosely woven predominantly periclinal, thinwalled hyphae; thecium 65 μ tall; paraphyses slender, septate, about 2 μ in diameter, dichotomous above the asci, branches submoniliform, tips clavate, 6–7 $\times$ 4 μ, brown, thickwalled, reaching the surface of the brownish epithecial gel; asci cylindric-clavate, 40 $\times$ 10 μ, wall thin, tip 4 μ thick, 8-spored; ascospores ellipsoid, 6–10 $\times$ 4.5–5.5 μ, with a moderately thick epispore.

Our material has somewhat larger lobes and much larger apothecia, but otherwise agrees with Müller Argau's description.

NORTHERN RHODESIA: Abercorn, growing over roots of *Tridactyle teretifolia* Schltr. on *Brachystegia taxifolia* in dense shade, *A. A. Bullock 2105 pars*, International Red Locust Control Service, at Kew.

CAPE OF GOOD HOPE: without more definite locality or collector, in Tuckerman herb. sub *P. tiliacea*, at Farlow Herb.

PARMELIA (HYPOTRACHYNA) **ganguellensis** Dodge, sp. nov.

Type: Angola, Benguela, country of Ganguelas and Ambuelas, corticole, *J. Gossweiler*, rec'd 1910, at Kew.

Thallus 7–8 cm. diametro, alutaceo-brunneus, laevis, lobis 20 × 3–4 mm., subimbricatis, apicibus rotundatis, crenatis, sinibus non excisis; infra niger, rugosus verrucosusve; cortex superior 13 μ crassitudine, fastigiatus, granulis brunneis nubilatus; stratum algarum 50 μ crassitudine, continuum, cellulis 8 μ diametro, medulla K–, C–, KC–, 140–150 μ crassitudine, hyphis longitudinalibus, superne densioribus, inferne laxioribus contextis, 3–3.5 μ diametro; cortex inferior 15 μ crassitudine, niger, pseudoparenchymaticus.

Apothecia 1–3.5 mm. diametro, margine inflexo, crenato, excipulo laevi, disco castaneo; cortex amphithecialis superne 130 μ, inferne ad 42 μ tenuescens, pseudoparenchymatice fastigiatus; stratum algarum 50–80 μ crassitudine, continuum; medulla hyphis verticalibus laxius intertextis, nubilatis; stratum algarum sub parathecio 40 μ crassitudine, coloniis *Trebouxiae*; parathecium 65 μ crassitudine, fastigiatus; hypothecium 15 μ crassitudine, hyphis tenuibus periclinalibus; thecium 60 μ altitudine; paraphyses septatae, bis terve dichotomae super ascos, ramis moniliformibus; asci late clavati, pachydermei, 23 × 13 μ; ascosporae octonae, ellipsoideae 7–8 × 5–5.5 μ.

Thallus 7–8 cm. in diameter, smooth, buffy brown, lobes 20 × 3–4 mm., somewhat imbricate, tips rounded, crenate, axils not excised; underside black, closely verrucose and rugulose, rhizinose to the margin rhizinae mostly pulled off in collecting; upper cortex 13 μ thick, fastigiate, nubilated with brownish granules; algal layer 30 μ thick, continuous, cells densely packed above, more scattered below, 8 μ in diameter; medulla K–, C–, KC–, 140–150 μ thick, of thickwalled, predominantly longitudinal hyphae, closely woven above, looser below, 3–3.5 μ in diameter; lower cortex 16 μ thick, pseudoparenchymatous.

Apothecia 1–3.5 mm. in diameter, margin inrolled, crenate, exciple smooth, disc chestnut; amphithecial cortex 130 μ thick above, tapering to 42 μ thick below, of fastigiate pseudoparenchyma with very small lumina; algal layer 50–80 μ thick, continuous; medulla of predominantly vertical hyphae, more loosely woven than in the thalline medulla, somewhat nubilated with brownish granules; algal layer under the parathecium 50 μ thick, of discrete colonies of *Trebouxia*; parathecium 65 μ thick, similar to the amphithecial cortex in structure but with larger lumina; hypothecium 15 μ thick, of slender interwoven hyphae; thecium 60 μ tall; paraphyses septate, twice to thrice dichotomous above the asci, branches moniliform, imbedded in the epithecial gel, brownish in the upper 10 μ; asci broadly clavate, thickwalled with a thicker tip, 23 × 13 μ; ascospores short ellipsoidal, 7–8 × 5–5.5 μ.

The Northern Rhodesian specimen is larger and more mature than the type, growing over orchid roots, less appressed to the substrate, lobes somewhat more irregular.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, corticole, *J. Gossweiler,* rec'd 1910, type, at Kew.

NORTHERN RHODESIA: without locality, growing over orchid roots on bark, *A. A. Bullock* 20 Sept. 1949, at Kew.

PARMELIA (HYPOTRACHYNA) **Deightoni** Dodge, sp. nov.

Type: Sierra Leone, top of Sankon Biriwa Mt., 1930 m., ramulicole on bush, *F. C. Deighton 3504,* at Kew.

Thallus 3 × 1.3 cm., obscure olivaceo-alutaceus, K evanescenter flavescens, lobis imbricatis, 3 × 2 mm., marginibus crenatis, sinibus acutis, eciliatus; infra niger, rhizinis tenuibus, 0.3–0.5 mm. longitudine; cortex superior 25 μ crassitudine, fastigiatus; stratum algarum coloniis discretis *Trebouxiae,* 25 μ diametro, cellulis 4–5 μ; medulla K flavidula, C–, KC–, 40 μ crassitudine, hyphis longitudinalibus 6 μ diametro, pachydermeis; cortex inferior niger, 16–20 μ crassitudine, pseudoparenchymaticus ex hyphis longitudinalibus, cellulis pachydermeis, 6 μ diametro.

Apothecia 3 mm. diametro, substipitata, margine integro, inflexo, excipulo laevi, eciliata, disco subconcavo, imperforato, rufo; cortex amphithecialis 40–50 μ crassitudine, fastigiatus; stratum algarum 20–25 μ crassitudine, coloniis discretis, cellulis 6–7 μ diametro; medulla subdense contexta; stratum algarum sub parathecio 25 μ crassitudine, subcontinuum; parathecium 30 μ crassitudine, fastigiatum, gelifactum; hypothecium 15 μ crassitudine, hyphis tenuibus periclinalibus, compacte intertextis, inferne laxius; thecium 80–85 μ altitudine; paraphyses tenues, septatae, superne moniliformes, apicibus clavatis; asci clavati, 80 × 16 μ, pachydermei, apicibus incrassatis; ascosporae octonae, ellipsoideae, 10–13 × 5–6 μ, episporio teuni.

Thallus 3 × 1.3 cm., wrapped around twig, deep olive buff, K yellow, fading, C and KC bleaching to white, lobes rounded, 2 mm. wide, 3 mm. long, margin crenate with acute sinuses, eciliate, center sometimes minutely lobulate from injury to the upper surface; underside black, rhizinose to the margin, rhizinae slender, 0.3–0.5 mm. long; upper cortex 25 μ thick, fastigiate above from dichotomously branched hyphae, the upper 10–12 μ heavily nubilated with brownish granules; algal layer of discrete colonies of *Trebouxia,* 25 μ in diameter, cells 4–5 μ; medulla K very faint yellow, C–, KC–, 40 μ thick, of closely woven longitudinal hyphae 6 μ in diameter, lumina 1 μ; lower cortex black, 16–20 μ thick, of pseudoparenchyma from longitudinal hyphae, cells 6 μ in diameter with thick, dark brown walls.

Apothecia 3 mm. in diameter, very short stipitate, margin entire, inrolled, exciple smooth, eciliate, disc slightly concave, imperforate, bay; amphithecial cortex 40–45 μ thick, fastigiate, outer 15 μ dark brown; algal layer 20–25 μ thick, of discrete colonies, cells 6–7 μ in diameter; medulla moderately closely woven with some small air spaces; algal layer under the parathecium 25 μ thick in a nearly continuous layer; parathecium 30 μ thick, gelified, fastigiate but hyphae somewhat irregularly arranged; hypothecium 15 μ thick, of slender, periclinal hyphae, very

closely woven above, looser below; thecium 80–85 μ tall; paraphyses slender, septate, simple or sparingly dichotomous, branches moniliform, tips clavate, ending about 2 μ below the surface of the brownish epithecial gel; asci clavate, 80 $\times$ 16 μ, wall moderately thick, tips thicker; ascospores ellipsoidal, 10–13 $\times$ 5–6 μ, with a thin epispore.

SIERRA LEONE: summit of Sankon Biriwa Mt., 1930 m., ramulicole on bush, *F. C. Deighton 3504*, at Kew.

PARMELIA (HYPOTRACHYNA) SCOTTII Vainio, Hedwigia 3:(40). 1898.

Type: Uganda, Mt. Ruwenzori, *G. F. Scott-Elliott 12*.

Thallus probably 10–12 cm. in diameter, deep olive buff, peripheral lobes about 30 mm. long, 3–4 mm. wide, convex, repeatedly but irregularly dichotomous, sides sometimes lobulate, terminal lobes about 2 mm. wide, tips rounded, crenate, surface subnitid, somewhat rimulose toward the center, opaque, with abundant apothecia; underside black, rhizinose to the margin; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 6 μ in diameter, rather thinwalled, nubilated with brownish granules; algal layer 15–20 μ thick, nearly continuous, cells 6 μ in diameter; medulla K yellow in a narrow zone next the algal layer, the rest negative, C–, KC–, 95 μ thick, of closely woven longitudinal hyphae 3 μ in diameter, very thickwalled, the upper 55 μ very heavily nubilated with grayish granules; lower cortex 12 μ thick, of dark brown fastigiate pseudoparenchyma, cells 5–6 μ in diameter.

Apothecia abundant in the center of the thallus, sessile, 3–4 mm. in diameter, margin entire becoming subcrenulate in age, exciple smooth, disc imperforate, slightly rugulose, chestnut, flattened but remaining concave; amphithecial cortex 40 μ thick, gelified, fastigiate, protoplasts about 1.5 μ in diameter, submoniliform but not clearly septate; algal layer nearly absent, represented by an occasional colony 30 μ in diameter, just within the medulla; medulla closely woven; algal layer under the parathecium 30 μ thick, nearly continuous, cells closely packed; parathecium 50–65 μ thick, of fastigiate pseudoparenchyma, protoplasts 3 μ in diameter, very deeply staining; hypothecium 30 μ thick, of moderately closely woven slender, periclinal hyphae, much less deeply staining; thecium 65 μ tall; paraphyses septate, about 2 μ in diameter, tips clavate, 5 μ in diameter, reaching the surface of the brownish epithecial gel; asci clavate, about 30 $\times$ 12 μ, wall moderately thick, tips somewhat thicker; ascospores short ellipsoid, about 8 $\times$ 5.5 μ (immature). *Dümmer 3397a* has maturer ascospores 13.5–16 $\times$ 8 μ.

Only the upper part of the medulla of our specimens is K yellow. Perhaps if Vainio shaved off only the cortex and algal layer in exposing the medulla for his test, he would not have noted that the lower part is K–. Probably it is the grayish granules confined to the upper part which react with K.

EAST TROPICAL AFRICA: between 2° and 7° S., *J. Hannington*, det. *P. tiliacea* by Müller Argau, at Kew.

UGANDA: Mt. Elgon, summit of Jackson's Peak, on rocks, 4580 m., *R. A. Dümmer 3397a*, Dümmer-Maclennan Exp., at Kew.

Parmelia (Hypotrachyna) leptascea Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:514. 1926.

Type: Tanganyika?, Lake Victoria, corticole, *Schroeder 319*.

Thallus about 6 cm. long, 2.2 cm. wide, surrounding small branches, deep olive buff, lobes growing lengthwise of the twig, about 20 mm. long, 5 mm. wide, irregularly subpinnatifid, with lobes about 3 mm. long and wide, with rounded sinuses, lobes growing around the twig 20 mm. wide, 8–10 mm. long, deeply crenate with rounded sinuses, surface smooth, minutely white reticulate but not cracked; underside black, densely rhizinose in the center, less so on the lobes, rhizinae 1–2 mm. long, much branched, those just back of the margin mostly simple and simulating marginal cilia, tips somewhat swollen and bulb-like when in contact with the substrate; upper cortex 13 μ thick, of fastigiate pseudoparenchyma, cells 4 μ in diameter; algal layer 20–25 μ thick, nearly continuous, cells 6–7 μ in diameter, interrupted at more or less regular intervals corresponding to the white reticulations of the surface of the thallus; medulla K–, C–, KC– (variously lutescent and more or less rufescent in original description), 80–85 μ thick, of thickwalled, closely woven longitudinal hyphae 5–6 μ in diameter, lumen 1 μ, with large air spaces just under the algal layer and tearing on sectioning, very heavily nubilated with grayish granules, somewhat looser with air spaces next the lower cortex; lower cortex 16 μ thick, black, of fastigiate pseudoparenchyma, cells subspherical, about 4 μ in diameter; rhizinae 75 μ in diameter, formed by downward branches of medullary hyphae, corticated from cells of the lower cortex.

Apothecia abundant, often crowded, pedicellate and deeply urceolate at first, finally nearly plane, 4–6 (–14) mm. in diameter, margin entire, slightly inflexed, exciple smooth, subnitid, disc chestnut, imperforate; amphithecial cortex 16 μ thick at the margin, expanding to 35 μ below, similar in structure to the thalline cortex, heavily nubilated throughout at the margin, less so and only in the outer half below; algal layer 25–30 μ thick, of close discrete colonies; algal layer under the parathecium 25–30 μ thick, nearly continuous with occasional algal cells from either layer penetrating the medulla; parathecium 20–25 μ thick, of fastigiate pseudoparenchyma; hypothecium 16–18 μ thick, of slender, thinwalled hyphae, more deeply staining next the parathecium; thecium 65 μ tall; paraphyses 2–2.5 μ in diameter unbranched, tips clavate, about 3.8 μ in diameter, ending in the dark brown epithecial gel about 7 μ thick; asci ellipsoidal, 42–45 $\times$ 16–17 μ, tip thickened when young, 9-spored; ascospores distichous, broadly ellipsoid, 10 $\times$ 6.5 μ, with a thick epispore.

Spermogonia immersed, 170 μ in diameter, wall darkened about the ostiole, otherwise hyaline; spermatia bacilliform, 5–6 $\times$ 0.6 μ fide Steiner & Zahlbruckner.

Although the chemical reactions are completely negative and the dimensions are at about the lower limits of those given in the original description, our Nyasaland specimens seem to belong here. *Lythgoe L5* and *Turrall 70* have the medulla K yellow, slowly orange, KC yellow then orange, but otherwise agree.

Ethiopia: Chokke Mts. 10° 40′ N., 37° 45′ E., wood behind Camp I, 3220 m., on deeply shaded bush, *J. N. Lythgoe L5*, C.B.E.E., at Kew.

Uganda: Kigezi, Mafuga, 2250 m., corticole, *I. R. Dale* p. p. min.; Kipango, on bark of *Albizzia Brownei*, *R. A. Dümmer 602* p. p. min., both at Kew.

TANGANYIKA: Kilimanjaro, *R. G. Turrall 70*, growing over mosses, ex herb. E. African Agr. Res. Inst. Amani, at Kew.

NYASALAND: Nchisi Mt., 1600 m., on living *Loranthus* sp., *L. J. Brass 16995*; Cholo Mt., 1200 m., corticole in rain forest, *L. J. Brass 17730, 17746, 17748, 17788*, Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (HYPOTRACHYNA) ORCHIDOPHILA Dodge, Ann. Missouri Bot. Gard. 40:374. 1953.

Type: Uganda, Western Province, Toro District, Nyinabitsa, in ridge forest, 2500 m., on roots of *Tridactyle bicaudata* (Lindl.) Schltr., *H. A. Omastin 1184*, at Kew.

Thallus 3–4 cm. in diameter, 95–100 μ thick, deep olive buff, K very slowly pale yellow, lobes rounded, crenate, sinuses excised, ultimate lobules up to 3 mm. wide, margins ciliate, cilia 0.5 mm. long, surface smooth, slightly impressed, white reticulate, slightly rimulose; underside black with chestnut margins, rhizinae covering the whole underside, black with 1–2 dichotomous branches, about 1 mm. long in the center of the thallus, shorter toward the margin; upper cortex 12 μ thick, of thinwalled fastigiate pseudoparenchyma, cells 5 μ in diameter, nubilated with brownish granules; algal layer 16–20 μ thick, cells 5 μ in diameter; medulla K yellow then orange red, C–, KC–, 55 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter, heavily nubilated with white to pale buff granules, becoming orange in moribund thalli; lower cortex black, 12 μ thick, pseudoparenchymatous, cells 4 μ in diameter; rhizinae 20 μ in diameter. Apothecia not seen.

KENYA: Eldoret, 2220 m., on uliowa tree near Lamok river, growing over roots of *Polystachya spatella, G. R. Williams 90A*, at Kew.

TANGANYIKA: Ufipa, Chapota, growing over roots of *Polystachya* on *Brachystegia, A. A. Bullock 2035*; Nkundi Chapota, 2255 m., on roots of *Diaphananthe pulchella* on branch of *Acacia*, 6 m. up, in dense shade, *A. A. Bullock 1962* p. p. min.; both International Red Locust Control Service, at Kew.

UGANDA: Western Province, Toro District, Nyinabitsa, in ridge forest, 2500 m., on roots of *Tridactyle bicaudata* (Lindl.) Schltr. *H. A. Omastin 1184*, at Kew.

PARMELIA (HYPOTRACHYNA) SUFFIXA Stirton, Scottish Nat. 4:299. 1877-8.

Type: Cape of Good Hope, near Knysna, corticole, *J. B. Knobel.*

Thallus at least 6 cm. in diameter, marginal lobes deep olive buff, shading to chamois in the center, lower branches irregularly dichotomous, up to 1.5 mm. wide below, narrower above, upper branches subpinnate, sinuses excised or at least rounded, ultimate lobules truncate or retuse, 0.5 mm. wide, not truly ciliate but appearing so from the rhizinae near the margin bending outward; underside black, rhizinose to the margins, rhizinae slender, short, simple or branched, upper cortex 12–13 μ thick, fastigiate, cells rounded, 4–5 μ in diameter, very thickwalled, conglutinate; algal layer 20 μ thick, of solitary cells 9 μ in diameter and small colonies of *Trebouxia*, cells about 6 μ in diameter, between more or less vertical medullary hyphae in a continuous layer, with occasional cells deeper in the medulla; medulla K–, C deep pink, KC pink, 50 μ thick, of moderately closely woven longitudinal hyphae 3–4 μ in diameter, with occasional nearly vertical hyphae; lower cortex black, 10–13 μ thick, pseudoparenchymatous from longitudinal hyphae; rhizinae 30 μ in diameter.

Apothecia up to 11 mm. in diameter, cupulate at first, becoming nearly flat, sometimes cracking radially at maturity, margin crenulate, slightly inflexed at first, exciple smooth, disc chestnut, imperforate; amphithecial cortex 55 μ thick, of fastigiate pseudoparenchyma, cells rather thinwalled, rounded, about 10 μ in diameter, heavily nubilated with brownish granules; algal layer of discrete colonies about 30 μ in diameter; medulla very loosely woven; algal layer under the parathecium 40 μ thick, continuous; parathecium 20 μ thick, pseudoparenchymatous, of thickwalled periclinal hyphae, protoplasts deeply staining; hypothecium 15 μ thick, of slender, periclinal hyphae, scarcely staining; thecium 80 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches submoniliform, ending 5 μ below the surface of the pale brown epithecial gel; asci cylindric, 55 $\times$ 10 μ, wall thick, tip thicker, 8-spored; ascospores ellipsoidal, 13–14 $\times$ 6–8 μ.

Burchell 230, sterile, growing tangled with *P. Sanctae-Helenae* and glued tightly to the herbarium sheet, seems to be this species.

ST. HELENA: *Burchell 230*, at Kew.

SOUTH AFRICA: without locality, *Drège*, det. *P. sinuosa* v. *scortea* Laur. ex herb. Sonder in Tuckerman Herb. at Farlow Herb.; Swellendam, collector not given, possibly *Drège, no. 94*, originally det. "*Parmelia an crenulata mihi in Humb.*" in W. J. Hooker's handwriting, herb. Hookerianum, at Kew.

SUBG. AMPHIGYMNIA (Vainio) Dodge, comb. nov.

Parmelia sect. *Amphigymnia* Vainio, Etude Lich. Brésil 1:28. 1890.

Parmelia subg. *Euparmelia* sect. *Amphigymnia* Zahlbr. in Engler & Prantl, Nat. Pflanzenfam. 1*:213. 1907.

Parmotrema Mass., Atti I. R. Ist. Veneto Sci. Lett. Arti III. 5:248. 1860. The type of *Parmotrema* is *Parmelia perforata* (Wulf.) Ach.

Type: not designated.

Thallus monophyllous, lobes rounded, if long, relatively broad, margins entire or crenate, usually ascending, often lobulate or ciliate or both, nude below, usually in a broad zone more than 3 mm. wide; underside black in the center, margins usually some shade of brown; rhizinae stout, usually short, sparse when forming holdfasts, longer, tips acute resembling cilia when not making contact with the substrate; medulla white, rarely citrine in sect. *Subflavescentes*. Apothecia substipitate to stipitate, usually large; disc often perforate; parathecium usually of fastigiate hyphae or pseudoparenchyma but of periclinal hyphae or pseudoperenchyma in 12 African species, the lower part fastigiate, the upper part periclinal in 2 African species; asci usually thinwalled with only tips thickened when young or with wall up to 2.5 μ thick, but walls 3 μ thick or more with ascospores usually with thick epispores in 13 African species. Spermogonia of the usual type immersed in the thallus, but confined to bullate prominences resembling pseudostromata of *Pertusaria* in 2 African species.

This subgenus is usually divided into two sections: the *Subflavescentes* with the upper surface yellow green corresponding to sect. *Xanthoparmelia* in subg. *Euparmelia*, and the *Subglaucescentes* with the upper surface glaucous to gray, corresponding to *Hypotrachyna* of *Euparmelia*. In general this separation presents no problem, but in working with specimens long preserved in herbaria, one encounters the same problem as in separating *Xanthoparmelia* from *Hypotrachyna*, see p. 52.

1. Thallus yellow stramineous.....Sect. SUBFLAVESCENTES 2
1. Thallus ashy glaucous to almost white, at least not yellowish, sumetimes buff in old specimens.....Sect. SUBGLAUCESCENTES 14
2. Medulla citrine 3
2. Medulla white or color not recorded and presumed white.....4
3. Thallus impressed to subscrobiculate; apothecia stipitate, 10 mm. in diameter, exciple deeply scrobiculate; ascospores 30 × 13–15 μ, epispore 3 μ thick; corticole; Madagascar .....*P. paxinoides* Dodge
3. Thallus rugose; ascospores spherical, 8 μ in diameter; Réunion to Cape of Good Hope..... .....*P. sphaerospora* Nyl.
4. Thallus sorediose.....5
4. Thallus isidiose.....6
4. Thallus margins microphylline or lobulate.....9
4. Thallus neither sorediose, isidiose nor lobulate.....10
5. Surface and margins nodular, nodules 0.2–0.3 mm. in diameter, a few elongating to short, coarse isidia, a few eroded above and appearing as capitate soredia; margins eciliate; sterile; medulla K–, C–, KC–; corticole; Ethiopia to Tanganyika..*P. neghelliensis* Cengia Sambo
5. Soredia superficial, 0.2 mm. in diameter, margins eciliate, very rugose in the center; apothecia 10 mm. in diameter, margins very sorediate, exciple rugose to scrobiculate; ascospores 13 × 6.5 μ; medulla K–, C–, KC–; corticole; Cape of Good Hope..... .....*P. albaniensis* Dodge
5. Surface with pseudocyphellae growing out as capitate soredia; margins nodular with soralia soon confluent into a band of coarse granular soredia; apothecia up to 3.5 mm. in diameter, exciple smooth, becoming pseudocyphellate; ascospores 10–11 × 6–7 μ; medulla K–, C pink above, KC yellow; corticole; Ethiopia.....*P. ethiopica* Dodge
5. Soredia capitate, marginal, sometimes confluent, surface smooth, some lobes with rare cilia; sterile; medulla K–, C–, KC–; muscicole; Congo.....*P. Hendrickxii* Dodge
6. Thallus eciliate.....7
6. Thallus ciliate.....8
7. Surface smooth, center densely isidiose with slender isidia, 70 μ in diameter, simple or forked at tip; apothecia 3 mm. in diameter; ascospores 8 × 5 μ; medulla K–, C pink, KC pink; on palm trunks; Nyasaland.....*P. ecaperata* Müll. Arg.
7. Surface rugose with verrucae in the depressions growing out as simple or branched isidia; apothecia 2 mm. in diameter; ascospores 17 × 7–8 μ; medulla K–, C–, KC–; Kenya and Uganda.....*P. Steineri* Dodge
7. Surface transversely rimose, subverrucose, center with dense groups of coralloid isidia, 110 μ or more in diameter; medulla K yellow, red next the algal layer, C–, KC yellow then red; Réunion to Cape of Good Hope; belongs in *Xanthoparmelia*.....*P. Gyelniki* Dodge
8. Cilia up to 1 mm. long; medulla K–, C–, KC–; saxicole; Madagascar to Cape of Good Hope; belongs in *Xanthoparmelia*.....*P. xanthina* (Müll. Arg.) Vainio
8. Cilia 2–3 mm. long, flexuous; medulla K–, KC red; corticole; Madagascar..... .....*P. caperata* v. *madagascariacea* Hue
8. Cilia 1–2 mm. long; flexuous, branched; medulla K–, C–, KC–; saxicole; Nyasaland..... .....*P. nyasensis* Dodge
9. Center of thallus bullate rugose, eciliate; apothecia 5–6 (–10) mm. in diameter, exciple scrobiculate; ascospores 7–10 × 6–7 μ with thick epispore; corticole; Uganda..... .....*P. Hansfordi* Dodge
9. Surface of thallus smooth, nitid, lobes rather narrow, some lobulate; apothecia 5 mm. in diameter, exciple smooth to rugulose, nitid; ascospores 7 × 3 μ; Cape of Good Hope belongs in *Xanthoparmelia*.....*P. Leonora* Sprgl. in Mass.
10. Thallus ciliate 11
10. Thallus eciliate 12
11. Medulla K–, C–, KC–; apothecia 4–5 mm. in diameter, exciple smooth, nitid to slightly reticulate rimulose; ascospores 6–8 × 4–5 μ; saxicole; Cape of Good Hope..*P. Wrightii* Dodge
11. Medulla K yellow then red; apothecia 3–9 mm. in diameter, exciple rugulose to foveolate; ascospores 12–14 × 8–10 μ; South Africa; belongs in *Hypotrachyna*.....*P. Owaniana* Stirton
12. Disc caesio-pruinose glaucous; medulla K yellow, C–, KC red; resembling *P. caperata* v. *caperatula*; corticole; Tanganyika; belongs in *Xanthoparmelia*..... .....*P. glaucopis* (Müll. Arg.) Vainio
12. Disc not pruinose, some shade of brown.....13
13. Surface smooth, rugulose in center; medulla K yellow, C–, KC red; apothecia 1.5–2 mm. in diameter, margin thick, entire; exciple smooth, disc pale rufous; ascospores 12–16 × 6–8 μ; corticole; Cape of Good Hope..... .....*P. amplexa* Stirton
13. Surface smooth, center bullate with many spermogonia; medulla K–, C orange yellow, KC deeper yellow; apothecia 7–9 mm. in diameter, margin thin, crenate, inflexed, exciple rugose and shallowly scrobiculate, disc chestnut; ascospores 11 × 6 μ; ramulicole; Portuguese East Africa.....*P. inhaminensis* Dodge

13. Surface minutely rugulose in center; medulla K–, C pink, KC–; apothecia 10 (–15) mm. in diameter, disc auburn, exciple minutely scrobiculate; ascospores 11–14 × 6–7 μ; corticole; Uganda.....*P. Dalei* Dodge
13. Surface bullate cerebriform in center; medulla K–, C–, KC–; apothecia up to 10 mm. in diameter, disc chestnut to black, exciple smooth; ascospores 9–10 × 5 μ; terricole; Cape of Good Hope.....*P. Zeyheri* Dodge
13. Surface very rugose, underside pale; apothecia 4–7 mm. in diameter; margin crenulate, exciple smooth then rugose, disc fuscous brown; ascospores 9–11 × 6–7 μ; Somaliland .....*P. somaliensis* Müll. Arg.
14. Thallus subscrobiculate in center, rimose areolate, margins of cracks verrucose, papillate or subisidiose; areoles of cortex and algal layer easily flaking off; margins of lobes dentate, ciliate, cilia 2–3 mm. long; corticole; Cape of Good Hope....*P. rimulosa* Dodge
14. Thallus isidiose.....15
14. Thallus sorediose.....22
14. Thallus neither isidiose nor sorediose.....34
15. Thallus ciliate.....16
15. Thallus eciliate.....20
16. Isidia becoming bullate and microphylline along thalline cracks; underside black, margins somewhat lighter 17
16. Isidia simple or coralloid, not confined to margins or cracks in cortex.....18
17. Medulla K pale yellow, C red; cilia 0.5 mm. long; spermatia 9–11 × 0.5 μ; Cameroons..... .....*P. lobulascens* Steiner
17. Medulla K–, C pink; cilia 1–1.5 (–2) mm. long; exciple eciliate; Côte d'Ivoire..... .....*P. lophogena* des Abb.
17. Medulla K–, C–, KC–; cilia 2–3 mm. long; corticole; Cape of Good Hope.....*P. rimulosa* Dodge
18. Medulla K–, C pink; surface smooth, isidia both marginal and superficial.....19
18. Medulla K–, C–, KC–; surface scrobiculate, central lobes isidiose, isidia breaking down into soredia; corticole; St. Helena.....*P. Mellissi* Dodge
18. Medulla K yellow, C–, KC intense yellow; surface smooth, isidia superficial only; corticole; Uganda.....*P. pedicellata* v. *isidiosa* Dodge
19. Margins fimbricate lobulate, cilia 1–1.5 mm. long, central isidia short, simple, very fragile; medulla KC pink; Tanganyika.....P. *Braunii* Dodge
19. Margins with coralloid isidia, cilia 1–3 mm. long; central isidia coralloid; truncicole; Guinée.....*P. pseudocrinita* des Abb.
19. Margins and adjacent surfaces of central lobes with coralloid isidia; cilia 0.5–1.5 mm. long; apothecia 6–7 mm. in diameter, stipitate, margin lobulate and isidiose; exciple scrobiculate, coralloid isidiose along the ridges; ascospores 11–13 × 7–8 μ; Ilha Principe.....*P. Manni* Dodge
20. Isidia both superficial and marginal; black below; exciple isidiose; medulla C pink.....21
20. Isidia superficial only, black below, margins pale fuscous; exciple smooth; apothecia 16 mm. in diameter; ascospores 11 × 7 μ; medulla K–, C–, KC–; Tanganyika..... .....*P. Stuhlmanni* Dodge
20. Isidia marginal only, up to 2 mm. long, branched, 0.5 mm. in diameter, lobules 3–5 mm. wide; black below, margins chestnut; medulla K–, C–, KC–; corticole; Sierra Leone.....*P. lobulascens* v. *isidiosissima* Dodge
21. Medulla KC–; apothecia 10 mm. in diameter; ascospores (11.5–) 13 (–14.5) × 6.5 (–8) μ; saxicole; Côte d'Ivoire.....*P. pseudotinctorum* des Abb.
21. Medulla KC pink; apothecia 2–6 mm. in diameter; ascospores 18–21 × 10–11 μ; Réunion .....*P. meiosperma* (Hue) Dodge
21. Medulla KC–; sterile; Cape of Good Hope.....*P. meiosperma* v. *Ecklonii* Dodge
22. Soredia both marginal and superficial.....23
22. Soredia marginal only, sometimes invading the upper surface at the margin.....24
23. Margins ciliate; soredia hemispheric in submarginal rows, confluent along the margins; medulla K–, C–, KC–; ramulicole; Ethiopia.....*P. hababiana* Gyelnik
23. Margins eciliate; soredia subspheric, capitate on central lobules, not confluent; medulla K yellow, C–, KC–; Madagascar.....*P. imerinensis* Dodge
24. Margins ciliate; apothecia subpedicellate when present.....25
24. Margins eciliate; surface smooth.....29
25. Medulla K yellow, C–, KC intense yellow; surface finally reticulate rugulose; ascospores 13–19 (–20) × 7–9 μ; spermatia 15–28 × 0.6 μ; Kenya.....*P. pedicellata* Steiner
25. Medulla K black, C–, KC black; margins capitate sorediose and confluent; sterile; Uganda .....*P. nigrireagens* Dodge
25. Medulla K– 26
26. Medulla C pink or red.....27
26. Medulla C– 28
27. Surface smooth, subnitid; cilia 6 mm. long; sterile; Madagascar.....P. *Pooli* Dodge
27. Surface smooth, central lobes becoming rugulose; apothecia 4.5 mm. in diameter, exciple sorediose; ascospores 15–19 × 7–9 (–10) μ; thallus up to 17 cm. in diameter, cilia up to 2 mm. long; corticole; S. Africa.....*P. Cooperi* Steiner & Zahlbr.

27. Surface rugulose, minutely rimulose areolate in older portions; apothecia up to 9 mm. in diameter, disc perforate; ascospores 13 × 10 μ; thallus 4 cm. in diameter; cilia 2 mm. long; corticole;Uganda.....*P. subciliaris* (Vainio) Dodge
28. Medulla KC red; thallus lobes 20 mm. wide; apothecia 3–4.5 mm. in diameter, margins sorediose; ascospores 11–17 × 8–10 μ; corticole; S. Africa....*P. natalensis* Steiner & Zahlbr.
28. Medulla KC–; surface very coarsely longitudinally rugose, margins very crisped, confluent sorediose; thallus 35–45 cm. in diameter; sterile; Mauritius.....*P. Sieberi* Dodge
29. Medulla K and KC red, C–; marginal lobes crisped, ascending, sorediose; apothecial margins crenulate, sorediose, disc pale flesh color; ascospores 11–15 × 11–12 μ; Comoro Islands.....*P. Hildebrandtii* Krmphbr.
29. Medulla K–, KC– 30
30. Medulla pink, at least above.....31
30. Medulla C– 32
31. Central lobes somewhat lobulate, crisped, capitate soraliate and confluent; marginal lobes only slightly crisped, not sorediose; medulla C pink above, negative below; Kenya.....*P. Allenii* Dodge
31. Central lobes with continuous band of soredia, crisped, marginal lobes up to 20 mm. wide and long, margins smooth, somewhat crisped; medulla C pink throughout.....*P. cazengensis* Dodge
32. Central lobes lobulate bearing capitate soredia, very rarely the soredia nonstipitate and confluent; apothecia very rare, 3 mm. in diameter, margin lobulate, each lobule with a large capitate soralium, disc ochraceous tawny; corticole; Angola.....*P. Gossweileri* Dodge
32. Central lobes with a continuous band of soredia.....33
33. Marginal lobes 8–10 mm. wide, upper cortex 20 μ, lower cortex 15 μ, thick, both of fastigiate pseudoparenchyma; medulla 135 μ thick, of closely woven hyphae nubilated with brownish green granules; Guinée.....*P. subcentrarioides* des Abb.
33. Marginal lobes 15 × 15 μ; upper cortex 7 μ, of fastigiate pseudoparenchyma, cells 3.5 μ in diameter; lower cortex 7 μ thick, pseudoparenchymatous from longitudinal hyphae; medulla 50–55 μ thick, of very loosely woven hyphae, not nubilated; Cape of Good Hope.....*P. olivetoroides* Dodge
34. Margins ciliate.....35
34. Margins eciliate.....46
35. Margins of central or peripheral lobes or both lobulate to microphylline.....36
35. Margins not lobulate, lobes mostly very broad.....41
36. Underside black with very pale margins.....37
36. Underside black with dark margins.....38
37. Ascospores 23–28 × 12–14 μ; apothecia up to 7 mm. in diameter, exciple eciliate, smooth; medulla K–, C–, KC–; Madagascar.....*P. glaucocarpoides* Zahlbr.
37. Ascospores 15–19 × 7–9 (–10) μ; apothecia up to 4.5 mm. in diameter, exciple reticulate rugulose, eciliate; medulla K–, C red; S. Africa.....*P. Cooperi* Steiner & Zahlbr.
37. Ascospores 16–19 × 11 μ; apothecia 14–15 mm. in diameter, exciple reticulate rugulose to subscrobiculate, ciliate; medulla K–, C–, KC–; corticole; Nigeria.....*P. nigeriensis* Dodge
38. Ascospores over 19 μ long; exciple foveate to venose; medulla C– 39
38. Ascospores under 17 μ long.....40
39. Apothecia 18–20 mm. in diameter, exciple foveate; ascospores 19–29 × 11.5–18 μ; lobules 1–3 × 0.5–1 mm.; medulla K yellow then unevenly orange rufous, KC–; corticole; Tanganyika.....*P. eurycarpa* Steiner & Zahlbr.
39. Apothecia 15 mm. in diameter; exciple reticulate rugose; ascospores 23–27 × 11–13.5 μ; medulla K yellow then red, C–; corticole; Côte d'Ivoire.....*P. inexspectata* des Abb.
39. Apothecia 10 mm. in diameter; exciple venose; ascospores 19–30 × 12–17 μ; lobules 1–4 × 1–1.5 mm.; medulla K–, KC reddish; Tanganyika.....*P. amaniensis* Steiner & Zahlbr.
40. Ascospores 10–13 × 7μ; apothecia 10 mm. in diameter, stipitate, exciple impressed to subrugose; medulla K–, C pink, KC pink; Angola.....*P. amboimensis* Dodge
40. Ascospores 13–17 × 5.5–7 μ; apothecia 28 mm. in diameter, stipitate, exciple nearly smooth, nitid; medulla K–, C–, KC red; Tanganyika.....*P. procera* Steiner & Zahlbr.
40. Ascospores 13–16 × 5–6 μ; apothecia 5 mm. in diameter, stipitate, exciple nearly smooth; medulla K yellow, C–, KC–; Aldabra Islands.....*P. aldabrensis* Dodge
40. Ascospores 10–15 × 7–9 μ; apothecia 10 (–15) mm. in diameter, very short stipitate, exciple reticulate rugose; medulla K–, C faint pink, KC–; Tanganyika.....*P. subbullata* (Steiner & Zahlbr.) Dodge
41. Underside pale, rhizinae pale or pellucid.....42
41. Underside dark in center with very pale margins; exciple eciliate.....43
41. Underside black in center with chestnut or fuscous margins.....44
42. Exciple nude or with rare cilia; ascospores 11–15 × 11–12 μ Tanganyika.....*P. Hildebrandtii* v. *ciliata* Müll. Arg.
42. Exciple smooth, margin thin, entire, eciliate; apothecia plane, disc fuscous; lobes elongate, margins sinuate; S. Africa.....*P. glaberrima* Fr.

43. Ascospores 14–16 × 8–10 μ; apothecia 10 mm. in diameter; exciple rugose; medulla K–, C–, KC–; Ethiopia.....*P. abessinica* Nyl. in Krmphbr.
43. Ascospores 11–15 (–17) × 6.5–8 (–9) μ; apothecia 10 mm. in diameter, exciple less rugose, rimose along the low ridges; medulla K–, C–, KC red to rufescent; Tanganyika.....*P. abessinica* f. *glabior* Steiner & Zahlbr.
43. Ascospores 20–28 × 11–16 μ; apothecia 10 mm. in diameter, exciple deeply scrobiculate; medulla K–, C and KC red; corticole; Nigeria.....*P. euneta* Stirton
44. Exciple ciliate.....45
44. Exciple eciliate; ascospores 20–24 × 10–15 μ; apothecia 6–10 mm. in diameter, exciple white reticulate to subscrobiculate; medulla K–, C and KC pink next the algal layer, fading, rest negative; Ethiopia.....*P. Schimperi* Müll. Arg.
45. Exciple surface not described; ascospores 16–18 × 9 μ; medulla KC–; Madagascar.....*P. melanothrix* v. *regressa* Vainio
45. Exciple very rugose; ascospores 16–20 × 9–11 μ; medulla K yellow, KC orange; thallus scrobiculate in the center; Kenya.....*P. uberrima* Hue
46. Margins lobulate to microphylline, usually on central lobes.....47
46. Margins not lobulate, lobes mostly broad.....50
47. Ascospores 8–14 × 6.5–8 μ; apothecia 7 mm. in diameter, short stipitate, exciple rugose; medulla K–, C–, KC–; Kenya.....*P. neirobiensis* Steiner & Zahlbr.
47. Ascospores 13–20 μ long.....48
47. Ascospores over 21 μ long.....49
48. Ascospores 13–20 × 8–11 μ; margins dentate with few lobules; apothecia 3–8 mm. in diameter, short stipitate, exciple smooth, white reticulate; medulla K–, C–, KC–; Kenya.....*P. odontata* Hue
48. Ascospores 13–16 (–18) μ long; exciple smooth; habit of *P. latissima*; S. Africa.....*P. Maclayana* Müll. Arg.
48. Ascospores 14–16 × 10 μ; apothecia 20 mm. in diameter, exciple deeply reticulate rugose, stipitate; lobules 1 × 1 mm.; medulla K–, C–, KC–; Uganda.....*P. Thomasii* Dodge
48. Ascospores 16 × 10 μ in 8-spored asci, 18–20 × 10–12 μ in 4-spored asci; apothecia 4–5 mm. in diameter, exciple smooth; margins dentate to lobulate, lobules 1 × 1 mm.; medulla K–, C–, KC–; Kenya Coast.....*P. litoralis* Dodge
49. Apothecia 2–6 mm. in diameter, subpedicellate, exciple smooth or slightly rugose; ascospores 21–25 × 10–12 μ; Madagascar.....*P. disparilis* Nyl.
49. Apothecia 8–12 mm. in diameter, pedicellate, exciple scrobiculate; ascospores 27–31 × 11–18 μ; ramicole; Réunion.....*P. appendiculata* Nyl.
50. Underside pale to pale fuscous, at least at margins.....51
50. Underside black, may be slightly lighter at the margins.....54
50. Underside unknown, poorly described.....57
51. Ascospores 9–12 μ long.....52
51. Ascospores 19–35 μ long.....53
52. Thallus very rugose; apothecia 4–7 mm. in diameter, exciple rugose; ascospores 9–11 × 6–7 μ; Somaliland.....*P. somaliensis* Müll. Arg.
52. Thallus smooth, nitid; apothecia 15 mm. in diameter, exciple smooth; ascospores 10–12 × 8–9 μ; medulla K–, C and KC red; Tanganyika.....*P. nitens* Müll. Arg.
52. Thallus rugose in center, margins smooth; apothecia up to 6 mm. in diameter, exciple smooth, radially rugose below; ascospores 9–10 × 4–5 μ; medulla K–, C–, KC–; on decorticate twigs; Madagascar.....*P. ramulicola* Dodge
53. Ascospores 19 × 11 μ; N. Rhodesia.....*P. Menyharti* Steiner
53. Ascospores 25–35 × 13–21 μ; medulla K–, C–; ramulicole; Cape of Good Hope.....*P. resupina* Stirton
54. Ascospores under 15 μ long.....55
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PARMELIA (AMPHIGYMNIA) **paxinoides** Dodge, sp. nov.

Type: Madagascar, Imerina, Andrangolaoka, corticole, *J. M. Hildebrandt*, Nov. 1880, sub *P. crinita* ex herb. Sbarbaro at Farlow Herb.

Thallus 5 cm. diametro, fragillima, cinnamomeo-alutaceus, roseo-alutaceusve, K–, lobis peripheris rotundatis, 20 × 15 mm., marginibus undulatis, crispatis, dense ciliatis, ciliis 4 mm. longitudine, subflexuosis, lobis centralibus lobulatis, lobulis 1 × 1 mm., ciliatis; superficies centro scrobiculata, marginibus impressa, apaca; infra niger, marginibus castaneo-brunneis, rhizinis nigris, in catervis parvis, 2–3 mm. longitudine, in catervis majoribus brevibus, hapteron commune 0.3 mm. diametro formantibus; cortex superior 10–12 μ crassitudine, fastigiatus, cellulis 10–12 × 6–7 μ, luminibus 1–2 μ diametro, granulis brunneis nubilatis; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 5–6 μ diametro; medulla citrina, K–, C viridi-flava, KC obscurior, 60 μ crassitudine, hyphis verticalibus laxe intertextis, 2–3 μ diametro, compactioribus et magis longitudinalibus sub strato algarum et super corticem inferiorem; cortex inferior 7–10 μ crassitudine, hyphis longitudinalibus, cellulis isodiametricis, 6–7 μ diametro.

Apothecia stipitata, cupiliformia, 10 mm., diametro, stipite 5 mm. altitudine, 3 mm. diametro, longitudinaliter subrugoso, rimoso-areolato, marginibus lobulatis, excipulo alte scrobiculato, disco castaneo; cortex amphithecialis 30 μ crassitudine, fastigiatus, hyphis 4–5 μ diametro, luminibus 1 μ, granulis brunneis nubilatis; stratum algarum 15 μ crassitudine, continuum, nubilatum; medulla compacta arachnoideave; stratum algarum sub parathecio 30 μ, crassitudine, continuum; parathecium 50 μ crassitudine, pseudoparenchymatice fastigiatum, superne cellulis subpericlinalibus; hypothecium 25 μ crassitudine, hyphis tenuibus, periclinalibus, dense intertextis, subgelifactis; thecium 105 μ altitudine; paraphyses tenues, ramosae, ramis ultimis submoniliformibus, apicibus clavatis; asci stipitati, ventre ellipsoideo, 30 × 16 μ, stipite 35 μ longitudine, pachydermei; ascosporae quinae senaeve, 30 × 15–16 μ, episporio 3 μ crassitudine.

Spermogonia submarginalia, 100 μ altitudine, 130 μ diametro, oblate sphaeroidea; fulcrum 7–8 μ crassitudine, pseudoparenchymaticum; cellulis ex hyphis periclinalibus obscure brunneis; spermatiophorae 55 × 1 μ, septatae; spermatia lateralia, recta 4 × 0.7 μ.

Thallus 5 cm. in diameter, probably larger, very fragile, cinnamon buff to pinkish buff (1957), K–, C bleached to white, peripheral lobes rounded, 20 mm. long, 15 mm. wide, margins undulate, crisped, quite closely ciliate, cilia 4 mm. long, flexuous, central lobes lobulate, lobules about 1 mm. wide and long, equally ciliate; upper surface impressed near the margins, shallowly scrobiculate toward the center, not or only slightly rimulose, opaque; underside black, shading to chestnut brown at the margins, shining, smooth to minutely rugulose; rhizinae black, in small groups 2–3 mm. long resembling cilia, if not making contact with the bark, others in larger groups stout, short ending in a common disciform

holdfast 0.3 mm. in diameter; upper cortex 10–12 μ thick, fastigiate, of cylindric cells 10–12 $\times$ 6–7 μ, lumina 1–2 μ in diameter, heavily nubilated with brownish granules; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter; medulla citron yellow (pigment soluble in alcohol), K– or slightly deeper yellow, C greenish yellow, KC deeper greenish yellow, 60 μ thick, very loosely woven, more closely woven and hyphae more longitudinal next the algal layer and the lower cortex, but of predominantly vertical hyphae, 2–3 μ in diameter, not nubilated; lower cortex near tips of lobes 7–10 μ thick, pseudoparenchymatous from longitudinal hyphae, cells 5–6 μ in diameter with moderately thick, dark brown walls, nearer the center of the thallus 20 μ thick, highly gelified, appearing amorphous in the inner half, outer half of cylindric cells 6 $\times$ 4 μ, heavily nubilated with brownish granules, outer 4 μ hyaline and amorphous.

Apothecia cupulate, stipitate, 10 mm. in diameter, stipe 5 mm. tall, 3 mm. in diameter, slightly longitudinally rugose, cortex areolate, yellow medulla showing from the cracks, margins lobulate at first, lobules mostly broken off in mature apothecium; exciple very deeply reticulate scrobiculate, tops of the larger ridges cracking and exposing the yellow medulla; disc burnt sienna to chestnut, very concave, imperforate; amphithecial cortex 30 μ thick, fastigiate, hyphae 4–5 μ in diameter, lumina about 1 μ, nubilated with brownish granules; algal layer 15 μ thick, continuous, heavily nubilated; medulla varying from closely woven to arachnoid; algal layer under the parathecium 30 μ thick, continuous, heavily nubilated; parathecium 50 μ thick, of thickwalled pseudoparenchyma, fastigiate below, cells irregularly arranged in the middle and almost periclinal above; hypothecium 25 μ thick, of slender periclinal, closely woven hyphae, somewhat gelified; thecium 105 μ tall; paraphyses slender, sparingly septate, several times dichotomous in the lower and upper thirds, ultimate branches slightly moniliform, tips clavate in the brownish epithecial gel; asci 5–6-spored, stipe 35 μ long, venter ellipsoid, 30 $\times$ 16 μ, walls 6–7 μ thick when young, thinning as the ascospores mature; ascospores oblong-ellipsoid, 30 $\times$ 13–16 μ, epispore 3 μ thick.

Spermogonia submarginal, oblate spheroidal, 100 μ tall, 130 μ in diameter; wall 7–8 μ thick, pseudoparenchymatous from dark brown periclinal hyphae, neck about 60 μ, outside diameter; spermatiophores septate, 65 $\times$ 1 μ; spermatia lateral, straight, about 4 $\times$ 0.7 μ.

MADAGASCAR: Imerina, Andrangolaoka, corticole, *J. M. Hildebrandt*, Nov. 1880, sub *P. crinita* ex herb. Sbarbaro at Farlow Herb.

PARMELIA (AMPHIGYMNIA) **neghelliensis** (Cengia Sambo) Dodge, comb. nov.

Parelia soredica v. *neghelliensis* Cengia Sambo, R. Accad. Ital. Miss. Biol. Paese Borana, Rec. Bot. Lich. 380. 1939.

Type: Ethiopia, Borana, Neghelli, on *Juniperus, Cufodontis.*

Thallus at least 9 cm. in diameter, probably larger, deep olive buff to olive buff, peripheral lobes at least 10 mm. long, 3–5 mm. wide, irregularly dichotomous and subpinnate, very imbricate, sinuses rounded, margins crenate, eciliate, reticulate rimulose, surface smooth or nearly so; central lobes much smaller, surface and

margins nodular, nodules 0.2–0.3 mm. in diameter, mostly subspheric, some more elongate like very coarse isidia, usually remaining corticate, a few with eroded cortex resemble small capitate soredia but not truly so; underside black to the margin, opaque, reticulate rugulose, rhizinae not abundant, stout, short, ending in disciform holdfasts; upper cortex 30 μ thick, of thinwalled, fastigiate pseudoparenchyma, cells about 4 μ in diameter, somewhat nubilated by pale brownish granules in the upper half; algal layer about 40 μ thick, continuous, cells 7–8 μ in diameter, a few cells deeper in the medulla; medulla K–, C–, KC–, 105 μ thick, of moderately closely woven predominantly oblique and longitudinal hyphae, slightly nubilated with hyaline granules; lower cortex 16–19 μ thick, of fastigiate pseudoparenchyma, cells 6–7 μ in diameter with moderately thick dark brown walls.

The nodules are formed by a vertical strand of medullary hyphae about 30 μ in diameter, pushing upward and carrying the algal layer and upper cortex with it; the upper cortex becomes thinner, about 16 μ thick and finally erodes at the top of the nodule, exposing the algal layer, but the algae are not formed into typical soredia, although there is a tendency for the algal cells to be grouped in colonies of varying size. This species does not seem to be closely related to *P. soredica* from western North America and even Cengia Sambo thought it might be a distinct species.

TANGANYIKA: Usambara, Muandara forest, corticole, *C. Holst 2662* p. p., rather fragmentary, at Kew.

PARMELIA (AMPHIGYMNIA) **albaniensis** Dodge, sp. nov.

Type: Cape of Good Hope, forests of Albany, corticole, *Zeyher 3*, in Taylor Herb. sub "allied to *P. rugosa* T." det. *P. caperata* by Tuckerman, at Farlow Herb.

Thallus ad 6 cm. diametro, inter citrino-ravus et obscure olivaceo-alutaceus, lobis peripheric is 10 × 8–10 mm., marginibus crenatis, sinibus acutis, apicibus subtruncatis, tenuiter nigro-marginatis, eciliatus, superficies transversim rugosa, soralia capitata, 0.2 mm. diametro, sorediis granulosus; infra niger, opacus, rhizinis paucis, ca. 0.5 mm. longitudine; cortex superior 30 μ crassitudine, fastigiatus, hyphis 3–4 μ diametro, septatis, cellulis superne isodiametricis; stratum algarum 25 μ crassitudine, coloniis densis *Trebouxiae*, cellulis 6–11 μ diametro; medulla K–, C–, KC–, 160 μ crassitudine, zona superior 15 μ crassitudine hyphis verticalibus 3 μ diametro, laxissimis, zona media ca. 100 μ crassitudine, hyphis longitudinalibus laxe intertextis, granulis griseis nubilatis, et zona inferiori 45 μ crassitudine hyphis longitudinalibus compactis non nubilatis; cortex inferior 20 μ crassitudine, niger, pseudoparenchymatice fastigiatus.

Apothecia ad 10 mm. diametro, margine crenato juventute inflexo, sorediosо, excipulo rugoso-scrobiculato, disco rufo-brunneo; cortex amphithecialis 45 μ crassitudine, pseudoparenchymatice fastigiatus, stratum algarum 30 μ crassitudine, coloniis discretis, granulis brunneis nubilatis; medulla hyphis compacte intertextis; stratum algarum sub parathecio 30 μ crassitudine, subcontinuum; parathecium 30 μ crassitudine, hyphis periclinalibus pseudoparenchymaticum, lumina 3–4 × 2 μ; hypothecium 25 μ crassitudine, hyphis tenuibus periclinalibus, laxe intertextis; thecium 80 μ altitudine: paraphyses tenues, septatae, bis terve dichotomis, apicibus

subincrassatis; asci clavati, 65 × 15 μ, pachydermei; ascosporae octonae ellipsoideae, 13 × 6.5 μ, episporio crasso.

Thallus of several fragments with cortex and algal layer rubbed off in spots from rough handling, at least 6 cm. in diameter, probably larger, between citrine drab and dark olive buff, shading toward vinaceous buff on some fragments (1957), one peripheral lobe at least 10 mm. long, 8–10 mm. wide, sinuses rounded, closely appressed to the bark, margin deeply crenate with acute sinuses, tips nearly truncate, smooth, very narrowly black margined, eciliate, surface transversely rugose toward the margin, more irregular toward the center with capitate soralia, 0.2 mm. in diameter, soredia granular; underside black, opaque to the margins, rhizinae few, stout, about 0.5 mm. long, mostly torn away, carrying a small portion of the lower cortex; upper cortex 30 μ thick, fastigiate, hyphae 3–4 μ in diameter, thin-walled, once dichotomous just above the algal layer and again about 15 μ from the surface, ultimate branches conglutinate and gelified, but apparently septate into isodiametric cells; algal layer 25 μ thick of closely packed colonies of *Trebouxia*, cells 6–11 μ in diameter; medulla K–, C–, KC– or faint yellow, 160 μ thick, with an upper zone 15 μ thick with large air spaces and vertical hyphae, 3 μ in diameter, which grow up between the algal colonies to form the upper cortex, not nubilated, a middle zone about 100 μ thick, of loosely woven, predominantly longitudinal hyphae, the interstices filled with grayish granules and a lower zone 45 μ thick, of closely woven longitudinal hyphae, not nubilated; lower cortex 20 μ thick, black, of fastigiate pseudoparenchyma, easily tearing from the medulla on sectioning.

Apothecia up to 10 mm. in diameter, margin deeply crenate and inflexed when young, forming a narrow continuous band of soredia, exciple rugose scrobiculate, disc auburn; amphithecial cortex 45 μ thick, of fastigiate pseudoparenchyma; algal layer up to 30 μ thick, of discrete colonies, heavily nubilated with brownish granules, dying in places and medullary hyphae making contact with the cortex; medulla quite closely woven, heavily but irregularly nubilated; algal layer under the parathecium 30 μ thick, colonies nearly continuous; parathecium 30 μ thick, of gelified pseudoparenchyma from periclinal hyphae, lumina 3–4 × 2 μ; hypothecium 25 μ thick, of slender loosely woven, periclinal hyphae; thecium 80 μ tall; paraphyses slender, septate, twice to thrice dichotomous above the asci, tips slightly clavate, reaching the surface of the brownish epithecial gel; asci clavate, 8-spored, 65 × 15 μ, wall 3μ thick, tips somewhat thicker; ascospores short ellipsoid, 13 × 6.5 μ, with a moderately thick epispore.

Before the type specimen was collected, patches of the thecium had been eaten. Where only the parathecium was exposed, there was no regeneration, but where the algal layer underneath was exposed, the algae proliferated to form granular soredia about 30 μ in diameter.

CAPE OF GOOD HOPE: forests of Albany, corticole, *Zeyher 3*, type, in Taylor Herb. sub "allied to *P. rugosa* T." det. *P. caperata* by Tuckerman in Taylor Herb. at Farlow Herb.; without locality or collector but probably duplicate of the above, Herb. Hookerianum at Kew.

NATAL: Drakenberg, *Feilden*, det. *P. caperata* by Müller Argau, at Kew (2 collections).

PARMELIA (AMPHIGYMNIA) **ethiopica** Dodge, nom. nov.

Parmelia cristifera v. *abissinica* Cengia Sambo, Nuovo Giorn. Bot. Ital. 46:445. 1939, non *P. abessinica* Nyl. in Krmph., 1877.

Type: Ethiopia, Addis Ababa, corticole, *Senni 92*.

Thallus 10 cm. or more in diameter in confluent patches, green when fresh, drying to ecru-olive and dark olive buff, K–, lobes imbricate, marginal lobes up to 10 mm. long and wide, margins rounded, shallowly crenate to crenulate, central lobes nodular soraliate, soon confluent into a band of white, coarse granular soredia; upper surface of marginal lobes slightly rugose and pseudocyphellate, central lobes more deeply rugose to somewhat scrobiculate with pseudocyphellae growing out to form nodular soralia up to 0.5 mm. in diameter; eciliate; underside black, minutely reticulate rugulose shading to russet at the smoother margins; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, hyphae about 4 μ in diameter, cells longer than wide, upper third brownish; algal layer about 15 μ thick, of close, discrete colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K–, C pink in upper portion, negative below, KC yellow, 130 μ thick, upper half of moderately dense vertical hyphae interlaced with longitudinal hyphae, densely nubilated with grayish granules, lower half of predominantly longitudinal hyphae, very closely woven, 3–4 μ in diameter; lower cortex black, 13–16 μ thick, pseudoparenchymatous from longitudinal hyphae.

Apothecia up to 3.5 mm. in diameter, sessile, margins entire at first becoming sorediate, exciple smooth becoming pseudocyphellate, disc deeply urceolate becoming nearly plane, orange rufous or darker; amphithecial cortex 30 μ thick, similar to the thalline cortex; algal layer 20 μ thick, continuous but cells not closely packed, 9–10 μ in diameter; medulla very loosely woven, not nubilated; algal layer under the parathecium 35 μ thick, continuous, cells closely packed; parathecium 20 μ thick, of very thickwalled, interwoven periclinal and oblique hyphae, rather closely septate, not sharply differentiated from the hypothecium, scarcely staining; hypothecium 20 μ thick, of thinner-walled periclinal, deeply staining hyphae, less closely septate; thecium 65 μ tall; paraphyses thickwalled, closely septate, tip clavate to subspheric, 3 μ in diameter, ending in the pale brownish epithecial gel; asci 35 $\times$ 10 μ, clavate becoming ellipsoidal, 8-spored, 50 $\times$ 20 μ, walls 3 μ thick, tips 6 μ; ascospores subdistichous, broadly ellipsoidal, 10–11 $\times$ 6–7 μ with a thick epispore.

All the characters reported for *P. cristifera* v. *abissinica* agree with our material and none are even remotely related to *P. cristifera* Tayl. from India, (see p. 178), which apparently Cengia Sambo had not seen. Since there is already a *P. abessinica* Nyl. in Krmph. it seems unwise to use Cengia Sambo's varietal name which differs in spelling by a single letter. As her material is sterile, the description of the apothecia is based on *Gillett 5432*. *Gillett 4707* is young with beginnings of pseudocyphellae and apothecia up to 1 mm. in diameter. This species seems related to *P. somaliensis* from which it differs in its pseudocyphellae and marginal soredia.

ETHIOPIA: Luka, 9° 25′ N., 41° 40′ E., 2415 m., on *Juniperus procera* in regenerating forest, *J. B. Gillett 5432*, Abyssinia-Somaliland Boundary Commission, at Kew.

SOMALILAND: ridge south east of Andoba, 1740 m., 9° 59′ N., 43° E., on *Euphorbia* trunk, *J. B. Gillett 4607*, Abyssinia-Somaliland Boundary Commission, at Kew.

KENYA: Eldoret on Lamok River, 2220 m., growing over roots of *Polystachya spatella* on uliowa tree, *G. R. Williams 90A* p. p. min. at Kew; east side of Mt. Elgon, 2575 m., corticole, *A. Burnet L16a, L25a*; Kiambu District, Limuru, 2130 m., *A. Burnet 1*, all in Makerere College Herb.

PARMELIA (AMPHIGYMNIA) **Hendrickxii** Dodge, sp. nov.

Type: Congo, Kahusi, growing over mosses, *F. L. Hendrickx 4307* p. p. min. in E. African Herb.

Thallus ca. 8 cm. diametro, citrino-ravus aut obscure olivaceo-alutaceus, lobis ad 25 mm. latitudine, marginibus rotundatis, subcrenulatis, subcrispatis, aliis lobis capitato-sorediatis, raro confluenter sorediatiatis, alteris pauci-ciliatis, cilia 2 mm. longitudine; infra niger, rugosus, zona marginali 5–6 mm. latitudine laevi, nitida, roseo-alutacea, rhizinis 2 mm. longitudine; cortex superior 16–17 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5–6 μ diametro; stratum algarum 16–20 μ crassitudine, continuum, cellulis 6–7 μ diametro; medulla K–, C–, KC–, 65 μ crassitudine, hyphis longitudinalibus laxe intertextis; cortex inferior 10 μ crassitudine, hyphis longitudinalibus, cellulis isodiametricis.

Thallus about 8 cm. in diameter, citrine drab to deep olive buff, lobes up to 25 mm. broad, variously shaped, margins rounded, somewhat crenulate, slightly crisped, surface smooth to slightly rugose toward the center, margins of some lobes small capitate sorediate, rarely confluent, other lobes with very rare cilia 2 mm. long; underside black, rugose with a marginal zone 5–6 mm. wide, smooth shining, shading from sepia to pinkish buff; rhizinae rare, coarse, 2 mm. long; upper cortex 16–17 μ thick, of fastigiate pseudoparenchyma, but cells 5–6 μ in diameter somewhat irregularly arranged, lumina 2 μ in diameter; algal layer 16–20 μ thick, continuous, cells 6–7 μ in diameter; medulla K–, C–, KC–, 65 μ thick, of loosely woven, predominantly longitudinal hyphae with some vertical hyphae and moderately large air spaces under the algal layer and narrower ones next the lower cortex; lower cortex 10 μ thick, pseudoparenchymatous from longitudinal hyphae, somewhat irregularly arranged.

CONGO: Kahusi, muscicole, *F. L. Hendrickx 4307* p. p. min. in E. African Herb.

PARMELIA (AMPHIGYMNIA) ECAPERATA Müll. Arg., Flora **74**:378. 1891.

Type: Nyasaland, along Shire River, between Lake Nyasa and the Zambesi River, on palm trunks, *Kirk*.

Thallus more than 10 cm. in diameter, ivory yellow at the margins to between ecru olive and citrine drab in the center, marginal lobes rounded, 10 mm. long, 5 mm. wide, imbricated, appressed to the bark, margin smooth or occasionally minutely isidiose, sinuses rounded, surface smooth becoming rugulose toward the center which is densely covered with minute isidia, simple or forked at the tips, obscuring the surface of the thallus over large areas; underside black, smooth or nearly so, rhizinae short, stout; upper cortex 15 μ thick, of fastigiate, rather thin-walled pseudoparenchyma; algal layer about 40 μ thick, of discrete colonies of *Trebouxia*, cells 6 μ in diameter, densely packed above, less so below, nubilated with brownish granules; medulla K–, C and KC pale pink, 90 μ thick, of closely

woven longitudinal hyphae, heavily nubilated in the upper half with grayish granules; lower cortex 8–10 μ thick, of septate longitudinal hyphae, 4–5 μ in diameter.

Apothecia rare, sessile, about 3 mm. in diameter, margin thick, crenate, densely isidiose but isidia very fragile and mostly broken off, exciple densely isidiose, disc concave, mummy brown; amphithecial cortex 18–20 μ thick, of thickwalled, fastigiate pseudoparenchyma, interrupted at the scars of the broken isidia; algal layer 65 μ thick in a nearly continuous layer, cells 6–7 μ in diameter, densely packed next the cortex, more scattered within and some cells scattered deep in the loosely woven medulla; algal layer under the parathecium 55 μ thick, in a nearly continuous layer; parathecium 15–20 μ thick, of fastigiate pseudoparenchyma but the cells somewhat irregularly arranged; hypothecium 25 μ thick, of thickwalled periclinal conglutinate hyphae; thecium 60 μ tall; paraphyses twice or thrice dichotomous above the asci, branches moniliform, tips not thickened, reaching the surface of the brownish epithecial gel; asci clavate, 32 $\times$ 13 μ, wall 2.5 μ thick, tip thicker, protoplast mamillate, 8-spored; ascospores ellipsoid, 8 $\times$ 5 μ (perhaps still immature), only seen in the asci.

UGANDA: Bunyoro, Busingiro, on bark of old *Jacaranda* tree, *I. R. Dale L68c*, a fragment, at Kew.

TANGANYIKA: Usambara, Muandara forest, *C. Holst 2662*, det. *P. tiliacea* f. *scortea* by Müller Argau, at Kew; Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna*, *A. A. Bullock 1871* p. p. min., International Red Locust Control Service, at Kew.

PARMELIA (AMPHIGYMNIA) **Steineri** Dodge, nom. nov.

Parmelia caperata v. *isidiophora* Steiner, Sitzungsber. K. Akad. Wiss. Wien, Math. Naturw. Cl. I. 106:215. 1897.

Type: Kenya, Athi Plains, *Liechtenstein.*

Thallus over 12 cm. in diameter, dark olive buff to deep olive buff, lobes rounded, closely appressed, ultimate lobules 3–4 mm. long, 2–3 mm. wide, with minute rounded to excised sinuses; upper surface mostly smooth toward the margins, central portions rugulose and bullate rugose in the depressions, with irregular isidiose areas up to 10 mm. or more in diameter, isidia very slender, from coarsely granular to very short coralloid; underside black, shining shading to buckthorn brown or lighter, rugulose, nude at the margins, central portion nude or with patches of moderately close and short slender rhizinae, with subspheric tips where coming in contact with the substrate; upper cortex 22–25 μ thick, of fastigiate pseudoparenchyma, cells thinwalled, 5–6 μ in diameter, somewhat irregularly arranged, very heavily nubilated with greenish brown granules, interrupted by minute cracks 6–7 μ wide extending to the air spaces under the algal layer; algal layer 16–20 μ thick, a nearly continuous layer of colonies of *Trebouxia*, cells 6 μ in diameter; medulla K–, C–, KC–, 125 μ thick, very loosely woven under the algal layer to moderately close below, hyphae predominantly longitudinal but with many oblique and nearly vertical single hyphae in the upper half, about 2 μ in diameter, with scarcely visible lumina; lower cortex black, about 13 μ thick, of two layers of longitudinal, relatively thinwalled hyphae with isodiametric cells, the outer layer more or less collapsed, giving rise to rhizinae about 65 μ in diameter.

Apothecia rather rare, on the older portions of the thallus, 2 mm. in diameter, single or in crowded group of up to 4, deeply urceolate, substipitate; margins densely isidiose, exciple smooth below, disc bay to chestnut; amphithecial cortex 26–32 μ thick, of thinwalled fastigiate pseudoparenchyma, interrupted by outgrowth of isidia 30–35 μ in diameter, of closely packed algal cells, corticate with a single layer of cells 5 μ in diameter; algal layer 15–20 μ thick, nearly continuous under the amphithecial cortex, of more discrete colonies where isidia have grown out; medulla very loosely woven, hyphae somewhat brownish; algal layer under the parthecium 30–35 μ thick, continuous, of closely packed cells; parathecium 20 μ thick, of fastigiate pseudoparenchyma but cells somewhat irregularly arranged, 4–5 μ in diameter, walls rather thin; hypothecium 13 μ thick, of slender, periclinal hyphae, rather loosely woven; thecium 65 μ tall; paraphyses slender, once or twice dichotomous in the outer half, tips clavate in the very pale brownish epithecial gel; asci ellipsoid, 50 $\times$ 20 μ, with thick walls and tips when young, 8-spored but some spores may abort, leaving only 4–6 mature spores; ascospores ellipsoid, somewhat variable in size, but mostly 17 $\times$ 7–8 μ, epispore about 1 μ thick.

The above description is based largely on *Curtis 743b* as it is better developed and fertile. *Dale L46* p. p. min. seems to belong here although the center is citrine drab shading to dark olive buff and it is sterile, spermogonia abundant on some lobes.

KENYA: Loita Plains, 60 miles southeast of Narok, 1610–2250 m., growing over orchid roots on tree trunk, *Anita Grosvenor Curtis 743b*, in Dodge Herb.

UGANDA: Kigezi, Mafuga, 2415 m., saxicole, *I. R. Dale L46* p. p. min.; Bugishu, Butandiga, 2415 m., on trees, *A. S. Thomas 484* p. p. min.; both at Kew.

NIGERIA: *Barter 503*, Niger Exp. at Kew.

PARMELIA (AMPHIGYMNIA) **nyasensis** Dodge, sp. nov.

Type: Nyasaland, Mt. Nchisi, 1400 m., on dry rocks in *Brachystegia* woodland, *L. J. Brass 16922*, Vernay Nyasaland Exp. in Dodge Herb.

Thallus ca. 8 cm. diametro, flavus, lobis peripheric us rotundatis, crispatis, marginibus ciliatis, cilia 1–2 mm. longitudine, tenuia, ramosa, lobis centralibus dentatis isidiosisve, isidia tenuia, ad 1 mm. longitudine, coralloidea, fragilia; infra niger, marginibus laevibus, nitidis, umbrinis, rhizinis 2 mm. longitudine, simplicibus; cortex superior 10–12 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 3 μ diametro, pachydermeis, strato hypharum periclinalium dein amorpho tectus; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 5–6 μ diametro; medulla K–, C–, KC–, 50–55 μ crassitudine, hyphis nubilatis dense intertextis, laxioribus sub strato algarum; cortex inferior 8–12 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis parvis brunneis, subgelifactis.

Thallus about 8 cm. in diameter, between colonial buff and primrose yellow, peripheral lobes rounded, coarsely crisped, margins ciliate, cilia 1–2 mm. long, slender, sometimes branched, central lobes dentate to isidiose with isidia mixed with cilia extending in a marginal band up to 4 mm. wide, isidia slender, up to 1 mm. tall, coralloid branched, fragile, breaking off leaving pseudocyphelloid scars, surface

of the center of the lobes varying from smooth to impressed punctate and subrugose; underside black in the center, rhizinae stout, 2 mm. long, rather dense, unbranched unless the tips in contact with the substrate when they become densely branched and several join to form a common holdfast, marginal lobes shining, nude between Brussels brown and raw umber; upper cortex 10–12 μ thick, of fastigiate pseudoparenchyma, cells thickwalled, about 3 μ in diameter, covered by a layer of periclinal hyphae 4 μ thick, hyphae 2 μ in diameter, which soon gelifies into an amorphous layer; algal layer 15 μ thick, of discrete colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K–, C–, KC–, 50–55 μ thick, of closely woven nubilated hyphae, somewhat looser just under the algal layer; lower cortex 8–12 μ thick, of small celled fastigiate pseudoparenchyma, somewhat gelified and brownish.

In color and habit this species quite closely resembles *P. caperata* v. *madagascariacea* Hue, but differs in microscopic characters and in chemical reactions. Both taxa differ from *P. caperata* in the long-ciliate margins.

CONGO: Kahusi, 2700 m., *F. L. Hendrickx 4316* p. p. min., in E. African Herb.
NYASALAND: Mt. Nchisi, 1400 m., on dry rocks in *Brachystegia* woodland, *L. J. Brass 16922*, Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (AMPHIGYMNIA) **Hansfordi** Dodge, sp. nov.

Type: Uganda, Kampala, on bark of *Pithecolobium saman*, *C. H. Hansford 1455*, at Kew.

Thallus 13 cm. diametro, centro argillaceus vel cinnamomeo-alutaceus, bullato-rugosus, lobulatusque, marginibus obscure olivaceo-alutaceis, lobis rotundatis, 5 mm. latitudine longitudineque, crenatis lobulatisque, lobulis 0.5 mm. latitudine longitudineque; infra cinnamomeo-brunneus, marginibus ochraceo-alutaceis late nudis, minute rugosis; cortex superior 20 μ crassitudine, fastigiatus, gelifactus; stratum algarum 15μ crassitudine, continuum, cellulis 5–6 μ diametro; medulla K–, C–, KC– aut soride rufescens, 200–250 μ crassitudine, hyphis longitudinalibus laxe intertextis, dimidia parte media granulis hyalinis nubilata; cortex inferior 26 μ crassitudine in zonis duabus, interiori 10 μ crassitudine, obscure brunnea, hyphis longitudinalibus, cellulis pachydermeis isodiametrics, zona exteriori 16 μ crassitudine fastigiata, cellulis leptodermeis, pallidioribus.

Apothecia sessilia, 5–6 (–10) mm. diametro, margine integro dein crenulato, excipulo scrobiculato, nitido, disco ferrugineo; cortex amphithecialis 20 μ crassitudine, fastigiatus, gelifactus; stratum algarum 20 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*; medulla hyphis laxe intertextis; stratum algarum sub parathecio 25 μ crassitudine, continuum; parathecium 35 μ crassitudine, pseudoparenchymatice fastigiatum, cellulis pachydermeis; hypothecium 35 μ crassitudine, hyphis periclinalibus, tenuibus, leptodermeis laxe intertextis; thecium 55–65 μ altitudine; paraphyses tenues, septatae, super ascos dichotomae, ramis moniliformibus; asci clavati, pachydermei, 35 $\times$ 15 μ; ascosporae octonae, late ellipsoideae, 7–10 $\times$ 6–7 μ, episporio crasso.

Spermogonia oblate sphaeroideae, 80 μ altitudine, 100 μ diametro, fulcrum obscure brunneum, 6–7 μ crassitudine; spermatiophorae 15 μ longitudine, septatae, non bene visae; spermatia bacilliformia, ca. 6 $\times$ 0.6 μ.

Thallus at least 13 cm. in diameter, center clay color to cinnamon buff, shading to deep olive buff at the margins, center bullate rugose and lobulate, smooth at the margins, marginal lobes rounded, about 5 mm. wide and long, crenate to lobulate, lobules 0.5 mm. wide and long; underside cinnamon brown to Prout's brown, marginal lobes ochraceous buff or lighter, minutely rugose, nude; rhizinae torn away in collecting, carrying the lower cortex with them in irregular areas; upper cortex 20 μ thick, fastigiate, gelified; algal layer 15 μ thick, cells 5–6 μ in diameter, probably continuous when young, tending to die in places, leaving lacunae; medulla K–, C–, KC– to slightly sordid rufescent, 200–225 μ thick between the ridges, another 65–100 μ thick under the ridges and bullae, almost devoid of medullary hyphae, of loosely woven, predominantly longitudinal hyphae, very loose in the lower half, with a middle zone about 100 μ thick, very heavily nubilated with minute hyaline crystals and aggregates of crystals in the air spaces of the network, giving a grayish appearance in section; lower cortex 26 μ thick, in two layers, an inner dark brown layer 10 μ thick of pseudoparenchyma from longitudinal hyphae, cells thickwalled, 5 μ in diameter, and an outer layer 16 μ thick, of light brown, thinwalled, fastigiate hyphae.

Apothecia very abundant in the center of the thallus, sessile, 5–6 (–10) mm. in diameter, margin entire at first, becoming crenulate and distorted by mutual pressure of neighboring apothecia, exciple deeply impressed to scrobiculate, shining, cortex disappearing in places, exposing the medulla but not sorediate, disc ferruginous or darker, very concave to nearly plane when old; amphithecial cortex 20 μ thick, fastigiate, gelified; algal layer 20 μ thick, of discrete but nearly continuous colonies of *Trebouxia* with some cells deeper in the loosely woven medulla; algal layer under the parathecium 25 μ thick, continuous; parathecium 35 μ thick of fastigiate pseudoparenchyma, cells very thickwalled, slightly irregularly arranged, tending to become longitudinally oriented with larger, more deeply staining protoplasts above in a layer 20 μ thick and merging into the hypothecium 35 μ thick of strictly periclinal rather thinwalled hyphae, less densely interwoven; thecium 55–65 μ tall; paraphyses slender, septate, dichotomous above the asci, branches somewhat moniliform, reaching the surface of the epithecial gel; asci clavate, 35 $\times$ 15 μ, thickwalled with thicker tips when young, 8-spored; ascospores broadly ellipsoid 7–10 $\times$ 6–7 μ, with a moderately thick epispore.

Spermogonia 80 μ tall, 100 μ in diameter, oblately spheroid with conical neck 20–25 μ tall penetrating through the upper cortex; wall completely dark brown, 6–7 μ thick; spermatiophores about 15 μ long, septate, not very clearly seen; spermatia bacilliform, about 6 $\times$ 0.6 μ.

UGANDA: Kampala, on bark of *Pithecolobium saman*, *C. H. Hansford 1455*, at Kew.

PARMELIA (AMPHIGYMNIA) **Wrightii** Dodge, sp. nov.

Type: Cape of Good Hope, Simon's Bay, saxicole, *Charles Wright*, U. S. North Pacific Exploring Exp. in Tuckerman Herb. sub *P. conspersa* at Farlow Herb.

Thallus 11 cm. diametro, brunneus, marginibus obscure olivaceo-alutaceus, lobis 25 mm. longitudine, infra 5 mm., superne 10 mm. latitudine, sinuosus, varie lobulatus, apicibus crenatis, sinibus excisis, subimbricatis, lobulis ultimis 2 $\times$ 1

mm., marginibus integris, eciliatis, subnitidis, minute albo-reticulatis sed non rimulosis; infra minute reticulatim rugulosus, nigro-brunneus, rhizinis raris crassis, pallidis; cortex superior 20 μ crassitudine, fastigiatus, gelifactus, cellulis leptodermeis; stratum algarum 30 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 5–6 μ diametro; medulla K–, C–, KC–, 115–130 μ crassitudine, hyphis longitudinalibus 3 μ diametro, laxe intertextis, dichotomis, irregulariter granulis pallide brunneis nubilatis; cortex inferior 10 μ crassitudine, pseudoparenchymaticus, cellulis 5 μ diametro leptodermeis.

Apothecia urceolata, 4–5 mm. diametro, margine involuto, minute crenulato, excipulo laevi, nitido dein subreticulatim rimuloso, disco cinnamomeo-rufo vel avellaneo; cortex amphithecialis gelifactus, 30–65 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 6–7 μ diametro; stratum algarum 30 μ crassitudine, coloniis discretis; medulla laxe contexta; stratum algarum sub parathecio 30 μ crassitudine, continuum; parathecium 25 μ crassitudine, pseudoparenchymatice fastigiatum; hypothecium 25 μ crassitudine, hyphis tenuibus periclinalibus dense contextis; thecium 42 μ altitudine; paraphyses tenues, septatae, superne dichotomae, apicibus clavatis, 6 μ diametro; asci cylindrico-clavati, 35 $\times$ 9 μ, leptodermei; ascosporae octonae, ellipsoidea, 6–8 $\times$ 4–5 μ.

Thallus about 11 cm. in diameter, sayal brown shading to deep olive buff at the margins, main lobes 25 mm. long, 5 mm. wide below expanding to 10 mm. wide near the tips, sinuous to variously lobulate, tips deeply crenate with excised sinuses, somewhat imbricate, central lobes much smaller, dichotomous, ultimate lobules about 2 mm. long, 1 mm. wide, margins smooth, eciliate, surface smooth, somewhat rugose in the center, subnitid, minutely white reticulate, especially on the marginal lobes but not rimulose; underside minutely reticulate rugulose, bister in the center shading to sayal brown at the margins; rhizinae rare in small groups, stout, short, pale to almost hyaline, forming disc holdfasts when in contact with the substrate; upper cortex 20 μ thick, fastigiate, the upper 12 μ gelified, of large thinwalled cells, nubilated with brownish granules, the rest hyaline of vertical dichotomous hyphae 3 μ in diameter; algal layer 30 μ thick, of discrete, close colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K–, C–, KC–, 115–130 μ thick, of very loosely woven longitudinal hyphae 3 μ in diameter, dichotomously branched, densely nubilated with pale brown granules in some places not in others; lower cortex 10 μ thick, pseudoparenchymatous, cells 5 μ in diameter, with thin brownish walls.

Apothecia urceolate, 4–5 mm. in diameter, margin incurved, minutely crenulate, exciple smooth, shining, then slightly reticulate rimulose; disc cinnamon rufous to hazel; amphithecial cortex gelified, 60–65 μ thick, of fastigiate pseudoparenchyma, cells 6–7 μ in diameter, the outer 15 μ brownish and nubilated; algal layer 30 μ thick, of closely packed discrete colonies; medulla loosely woven; algal layer under the parathecium 30 μ thick, continuous; parathecium 25 μ thick, of fastigiate pseudoparenchyma, lumina 1 μ in diameter; hypothecium 25 μ thick, of slender, closely woven, periclinal hyphae; thecium 42 μ tall; paraphyses slender, septate, dichotomous above, tips clavate, 6 μ in diameter; asci cylindric clavate, 35 $\times$ 9 μ, walls relatively thin; ascospores ellipsoid, 6–8 $\times$ 4–5 μ.

CAPE OF GOOD HOPE: Simon's Bay, saxicole, *Charles Wright*, U. S. North Pacific Exploring Exp. in Tuckerman Herb. sub *P. conspersa*, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) **inhaminensis** Dodge, sp. nov.

Type: Portuguese East Africa, Inhambane, Inhamine, ramicole on *Coffea*, *D. Luiz Sousa*, Oct. 1937, at Kew.

Thallus 12 × 3.1 cm., obscure alutaceus, madefactus obscure olivaceo-alutaceus, centro bullato, scrobiculatusve multis cum spermogoniis, lobis peripheric is planis, 10 × 5 mm., marginibus crenatis, apicibus rotundatis; infra niger, marginibus brunneis, nitidis, subrugosis, nudis; cortex superior 16 μ crassitudine, fastigiatus, gelifactus; stratum algarum 35 μ crassitudine fere continuum, coloniis *Trebouxiae*, cellulis 5 μ diametro; medulla alba (cremea quando longe ad aerem exposita), K–, C aurantiaca, KC flavior, 65 μ crassitudine, hyphis longitudinalibus, pachydermeis, 4–5 μ diametro, sub strato algarum dense contextis nubilatis, medio laxioribus, inferne densioribus; cortex inferior 20–25 μ crassitudine, niger, pseudoparenchymaticus, cellulis pachydermeis, 5 μ diametro, luminibus 1 μ.

Apothecia substipitata, 7–9 mm. diametro, marginibus inflexis, crenatis, excipulo primum laevi dein rugoso subscrobiculatove, disco concavo, castaneo; cortex amphithecialis 25 μ crassitudine, fastigiatus, gelifactus, granulis brunneis nubilatus; stratum algarum 25 μ crassitudine, fere continuum; medulla laxissima; stratum algarum sub parathecio 25 μ crassitudine, continuum; parathecium inferne 45–50 μ crassitudine, 30 μ ad latera thecii, fastigiatum; hypothecium 30 μ crassitudine, hyphis tenuibus periclinalibus, infra laxis, supra densis; thecium 50 μ altitudine; paraphyses dichotomae super ascos, apicibus non incrassatis; asci cylindrico-clavati, 42 × 15 μ, pachydermei, apicibus subincrassatis; ascosporae octonae, ellipsoideae, 11 × 6 μ, episporio crasso.

Thallus 12 cm. long, 3.1 cm. wide, completely surrounding a branch of *Coffea*, deep colonial buff when dry, deep olive buff when moist, peripheral lobes plane, 10 × 5 mm., margins deeply crenate, tips rounded, central portion rugose scrobiculate and bullate with many spermogonia (giving the appearance of pseudostromata of *Pertusaria*); underside black with buckthorn brown margins, shining, slightly rugose, nude in the outer 3 mm.; upper cortex 16 μ thick, fastigiate, highly gelified; algal layer 35 μ thick, nearly continuous, of colonies of *Trebouxia*, cells spherical, 5 μ in diameter, often arranged in vertical rows between medullary hyphae but not filamentous; medulla cream color when long exposed to air, white when freshly exposed with a very narrow ochre-yellow zone next the algal layer, K–, C orange yellow, deeper next the algal layer, KC deeper yellow, 65 μ thick, of predominantly longitudinal hyphae, compactly woven under the algal layer and next the lower cortex, hyphae thickwalled, 4–5 μ in diameter, heavily nubilated with brownish granules just under the algal layer; lower cortex 20–25 μ thick, black, pseudoparenchymatous from longitudinal hyphae, very thickwalled, 5 μ in diameter, lumina 1 μ.

Apothecia substipitate, 7–9 mm. in diameter, margins inrolled, nearly concealing the disc when dry, crenate, exciple smooth at first, becoming rugose and shallowly scrobiculate; disc very concave, chestnut; amphithecial cortex 25 μ thick, fastigiate, gelified; algal layer 25 μ thick, continuous; medulla very loosely

woven, almost arachnoid; algal layer under the parathecium 25 μ thick, a few cells penetrating between parthecial hyphae; parathecium 45–50 μ thick below tapering to 30 μ thick at the sides of the thecium, fastigiate, gelified; hypothecium 30 μ thick, of very slender, periclinal hyphae, loosely woven below, more closely so above; thecium 50 μ tall; paraphyses slender dichotomous above the asci, tips not thickened, ending 16 μ below the surface of the brownish epithecial gel; asci clavate then cylindric, 42 $\times$ 15 μ, wall thick, thicker at the tip with a slightly mamillate protoplast when young, 8-spored; ascospores ellipsoidal, 11–13 $\times$ 6–8 μ, with a moderately thick epispore.

PORTUGUESE EAST AFRICA: Inhambane, Inhamine, ramicole on *Coffea, D. Luiz Sousa,* Oct. 1937, at Kew.

CAPE OF GOOD HOPE: Simon's Bay, Table Mt., on stones, collector not given, no. 306, Herb. Hookerianum at Kew.

PARMELIA (AMPHIGYMNIA) **Dalei** Dodge, sp. nov.

Type: Uganda, Toro, Fort Portal, 1625 m., on *Eucalyptus tereticornis, I. R. Dale L44,* at Kew.

Thallus 4 cm. diametro, flavo-olivaceus, lobis rotundatis, 10 mm. longitudine, 15 mm. latitudine, marginibus integris, subcrenatis, eciliatis, crispatis, laevibus; infra niger, minute reticulatim regulosus, rhizinis brevibus, singulis; cortex superior 10–12 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 5–6 μ diametro, granulis brunneis nubilatis; stratum algarum 20–30 μ crassitudine, subcontinuum, coloniis *Trebouxiae,* cellulis 6–7 μ diametro; medulla K–, C roseo, KC–, 100 μ crassitudine, hyphis longitudinalibus obliquisque, 6 μ diametro, compacte intertextis; granulis hyalinis nubilatis; cortex inferior 8–10 μ crassitudine, pseudoparenchymaticus ex hyphis periclinalibus, 3 μ diametro.

Apothecia 10 (–15) mm. diametro, stipitibus 2 mm. diametro, 3 mm. altitudine, longitudinaliter rugosis, marginibus crenatis, excipulo minute scrobiculato, disco perforato, rufo-brunneo, aetate rugoso-rimoso; cortex amphithecialis 30 μ crassitudine, pseudoparenchymatice fastigiatus, gelifactus, protoplastis 3 μ diametro; stratum algarum 35 μ crassitudine, continuum, coloniis subdiscretis, cellulis 6–8 μ diametro; medulla hyphis sub rugis laxius, inter rugas compactius intertextis; stratum algarum sub parathecio 30–40 μ crassitudine, subcontinuum, coloniis discretis; parathecium 15 μ crassitudine, hyphis periclinalibus conglutinatis; hypothecium 15 μ crassitudine, hyphis tenuibus periclinalibus non conglutinatis; thecium 60 μ altitudine; paraphyses tenues, septatae, super ascos dichotomae, ramis moniliformibus, apicibus non incrassatis; asci clavati dein ellipsoideae, leptodermei, 40 $\times$ 16 μ; ascosporae octonae, ellipsoideae, 11–14 $\times$ 7–8 μ, episporio crasso.

Thallus about 4 cm. in diameter, severally imbricately arranged over an area 16 cm. long and 4 cm. wide, yellowish olive to light yellowish olive, lobes rounded about 10 mm. long and 15 mm. wide, margins entire or slightly crenate, eciliate, crisped, occasionally lobulate from regeneration following breakage, lobules nearly circular, 4–5 mm. in diameter; surface smooth, minutely reticulate rugulose in the center; underside black to the margin or sometimes shading to olive brown on some lobes, minutely reticulate rugulose, rhizinae very short, stout, branching at the tip to form a lobate holdfast, mostly single on the central portion of the thallus;

upper cortex 10–12 μ thick, of thinwalled fastigiate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with brownish granules; algal layer 20–30 μ thick, nearly continuous, of colonies of *Trebouxia*, cells 6–7 μ in diameter; medulla K–, C pink, KC–, 100 μ thick, of moderately closely woven, longitudinal and oblique hyphae about 6 μ in diameter, lumina 3 μ, moderately nubilated with hyaline granules throughout, more closely woven and longitudinal next the lower cortex; lower cortex 8–10 μ thick, pseudoparenchymatous from thickwalled, periclinal hyphae 3 μ in diameter.

Apothecia 10 (–15) mm. in diameter, stipes 2 mm. tall, 3 mm. in diameter, longitudinally rugose; margins crenate, exciple minutely scrobiculate, disc perforate, very concave, auburn, nearly flat and rugose in age, the larger ridges cracking nearly to the center, dividing the disc into several sectors; amphithecial cortex 30 μ thick, of gelified fastigiate pseudoparenchyma, protoplasts 3 μ in diameter; algal layer 35 μ thick, of close discrete colonies, forming a continuous layer next the cortex, cells 6–8 μ in diameter, with an occasional cell deeper in the medulla; medulla closely woven between the ridges, loose under the ridges; algal layer under the parathecium 30–40 μ thick, of close, discrete colonies in a nearly continuous layer; parathecium 15 μ thick, of conglutinate periclinal hyphae; hypothecium 15 μ thick of slender septate periclinal hyphae, not conglutinate; thecium 60 μ tall; paraphyses slender, septate, dichotomous above the asci, branches moniliform, tips not thickened, ending about 8 μ below the surface of the brownish epithecial gel, a few reaching the surface; asci clavate becoming ellipsoid, 40 $\times$ 16 μ, 8-spored, wall relatively thin; ascospores ellipsoid, 11–14 $\times$ 7–8 μ, with a moderately thick epispore.

A single thallus in the group has a microphyllin margin on one lobe, lobules 0.3–0.4 mm. in diameter, and the upper surface on one side of the thallus has areas of minute coralloid isidia, scarcely more than coarsely granular isidia, the rest of the thallus and apothecia appear normal for this species. Apparently it is a teratologic specimen, showing regeneration following insect injury, as part of the thecium of one apothecium has been eaten by insects, exposing the medulla.

UGANDA: Toro, Fort Portal, 1625 m., on *Eucalyptus tereticornis, I. R. Dale L44,* at Kew.

PARMELIA (AMPHIGYMNIA) **Zeyheri** Dodge, sp. nov.

Type: Cape of Good Hope, forests toward Grahamtown, terricole, *Zeyher 2* in Taylor Herb. sub *P. rugosa* Taylor, det. *P. conspersa* by Tuckerman, at Farlow Herb.

Thallus 5 cm. diametro, viridis, lobis peripheric is 7 $\times$ 5 mm., rotundatis, marginibus integris, eciliatis, revolutis, laevibus, apocis; centro bullato subcerebriformive; infra niger, apocus, rugosus, rhizinis non visis; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, granulis brunneis nubilatus; stratum algarum 100 μ crassitudine, continuum, cellulis 10 μ diametro *Trebouxiae*; medulla K–, C–, KC–, 160 μ crassitudine, hyphis longitudinalibus dense intertextis, dimidia parte superiori granulis griseis nubilata; cortex inferior 15 μ crassitudine, niger, fastigiatus, pseudoparenchymaticus, rhizinis 65 μ diametro, ex hyphis medullaribus, cortice tectis.

Apothecia ad 10 mm. diametro, margine integro, subsulcato, involuto, excipulo laevi, disco urceolato, castaneo, dein plano nigroque; cortex amphithecialis 15 μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 50 μ crassitudine, sub parathecio 80 μ crassitudine; parathecium 30 μ crassitudine, psendoparenchymatice fastigiatum sed cellulis sub irregulariter dispositis; hypothecium 25 μ crassitudine, hyphis tenuibus periclinalibus; thecium 70 μ altitudine; paraphyses tenues, septatae, semel bisve dichotomae super ascos, apicibus subincrassatis; asci clavati, pachydermei, 50 $\times$ 15 μ; ascosporae octonae, ellipsoideae, 9–10 $\times$ 5 μ, episporio crasso.

Thallus at least 5 cm. in diameter, probably larger, sea-foam green, peripheral lobes 7 mm. long, 5 mm. wide, rounded, center concave, margins entire, eciliate, revolute, surface smooth, opaque, central portion very bullate and subcerebriform (resembling pseudostromata of *Pertusaria*) but spermogonia not confined to them; underside black, opaque, very deeply rugose, rhizinae not clearly seen; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, so heavily nubilated with brownish granules that structure is rather indistinct; algal layer 100 μ thick, cells 10 μ in diameter, uniformly distributed in a continuous layer, rarely of small colonies of about 10 cells of *Trebouxia*; medulla K–, C–, KC–, 160 μ thick, more loosely woven under the algal layer and heavily nubilated with grayish granules in the upper half, of closely woven longitudinal hyphae, 5–6 μ in diameter, not nubilated in the lower half; lower cortex 15 μ thick, black, of fastigiate pseudoparenchyma, pierced by small pores about 7 μ in diameter with a small air space underneath each; rhizinae 65 μ in diameter, formed by medullary hyphae corticate with cells from the lower cortex.

Apothecia up to 10 mm. in diameter, margin entire, very slightly sulcate, inrolled, sometimes splitting into several segments, exciple smooth, disc urceolate, chestnut, becoming plane and black at maturity; amphithecial cortex 15 μ thick, of fastigiate pseudoparenchyma; algal layer 50 μ thick, under the parathecium 80 μ thick, cells more closely packed than in the thalline algal layer; parathecium 30 μ thick, of thickwalled fastigiate pseudoparenchyma, but the cells rather irregularly arranged; hypothecium 25 μ thick, of closely woven, slender, periclinal hyphae, deeply staining in the upper half; thecium 70 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, tips very slightly clavate, reaching the surface of the brownish epithecial gel; asci clavate, 50 $\times$ 15 μ, wall nearly 3 μ thick, tip 5 μ, 8-spored; ascospores ellipsoid, 9–10 $\times$ 5 μ, with a moderately thick epispore.

MAURITIUS: Ponce Range, on stones and trunks of trees, *Philip B. Ayres*, at Kew.

CAPE OF GOOD HOPE: Uitenhage, *Zeyher 22* p. p., young, Herb. Hookerianum, at Kew; forests toward Grahamtown, *Zeyher 2*, terricole? (small grains of sand adhering to lower cortex), det. *P. conspersa* by Tuckerman, in Taylor Herb. sub *P. rugosa* Tayl., at Farlow Herb.

PARMELIA (AMPHIGYMNIA) **rimulosa** Dodge, sp. nov.

Type: Cape of Good Hope, Table Mt., corticole, *John MacGillivray*, Voy. Herald, at Kew.

Thallus 6 cm. diametro, dilute ochraceo-alutaceus, lobis peripheric is ad 13 mm.

longitudine, irregulariter dichotomis, sinibus rotundatis excisisque, lobulis ultimis aliis 2 mm. longitudine, 1–1.5 mm. latitudine, aliis rotundatis, 7–8 mm. diametro, marginibus dentatis ciliatisque, ciliis 2–3 mm. longitudine; superne laevis ad margines, rugulosus subscrobiculatusque in centro, rimoso-areolatus, ad margines rimorum minute verrucosus, papillatus vel subsidiosus, areolis corticis desquamescentibus; inferne niger, sublaevis, centro paucis cum rhizinis; cortex superior 30 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis pachydermeis, granulis brunneis nubilatis; stratum algarum 30–40 μ crassitudine, coloniis discretis confertis *Trebouxiae,* cellulis 4–5 μ diametro; medulla K–, C–, KC–, 55–80 μ crassitudine, superne hyphis subverticalibus laxe contextis, inferne longitudinalibus, dense contextis, 3 μ diametro, pachydermeis; cortex inferior 40 μ crassitudine, hyphis 4 μ diametro ad medullam, in parte exteram, ramis plus fastigiatis, plus pachydermeis.

Thallus 6 cm. in diameter, light ochraceous buff, peripheral lobes up to 13 mm. long, 4 mm. wide below, irregularly dichotomous with rounded to excised sinuses, ultimate lobules 2 mm. long 1–1.5 mm. wide, some rounded, 7–8 mm. in diameter, margins dentate, ciliate, cilia 2–3 mm. long, upper surface smooth near the margins, rugulose and subscrobiculate toward the center, rimose areolate, minutely verrucose, papillate and subisidiose along the margins of the cracks, with areoles of cortex flaking off in places; underside black to the margins, nearly smooth, rhizinae few, confined to the central portion; upper cortex 30 μ thick, of thickwalled fastigiate pseudoparenchyma, heavily nubilated with brownish granules; algal layer 30–40 μ thick, of close, discrete colonies of *Trebouxia,* cells closely packed in a nearly continuous layer above, more scattered below, cells 5–6 μ in diameter; medulla K–, C–, KC–, 55–80 μ thick, hyphae rather loosely woven and subvertical above, longitudinal and more closely woven below, 3 μ in diameter, very thickwalled; lower cortex dark brown, 40 μ thick, of longitudinal hyphae 4 μ in diameter next the medulla, branches more fastigiate with thicker walls in the outer portion.

CAPE OF GOOD HOPE: Table Mt., corticole, *John MacGillivray,* Voy. Herald, at Kew.

PARMELIA (AMPHIGYMNIA) **Mellissi** Dodge, sp. nov.

Type: St. Helena, corticole, *J. C. Melliss,* at Kew.

Thallus 12 cm. diametro, dilute ochraceo-alutaceus, lobis peripheric is 15 mm. longitudine latitudineque, rotundatis, marginibus crenatis, lobulatisque, ciliatis, ciliis 1 mm. longitudine, supercicie laevi, centro rugoso scrobiculatoque, isidiis in rugis fragillimis dein soredia granulosa formantibus; lobis centralibus parvioribus, crispatis imbricatisque, dentatis, ciliatis et isidiosis, isidiis fragillimis, ad 1 mm. longitudine; inferne niger, marginibus nudis brunneis, reticulatim rugosis; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, granulis brunneis nubilatus; stratum algarum 20 μ crassitudine, subcontinuum, cellulis *Trebouxiae,* 5–6 μ diametro; medulla K–, C–, KC–, 80 μ crassitudine, hyphis leptodermeis, longitudinalibus, 2.5 μ diametro dense contextis; cortex inferior 15 μ crassitudine, nigrobrunneus, hyphis longitudinalibus 3 μ diametro, cellulis isodiametricis.

Thallus at least 12 cm. in diameter, pale ochraceous buff, marginal lobes about 15 mm. wide and long, rounded, margins crenate to lobulate, ciliate, cilia 1 mm.

long, simple, surface smooth at the margin, increasingly rugose and scrobiculate toward the center, isidia on the ridges, very fragile and breaking down into granular soredia; central lobes smaller, variously crisped and folded, imbricate, margins ciliate, dentate to isidiose, the isidia spreading to the adjacent surfaces of the central lobes, up to 1 mm. long but very fragile and breaking down into soredia; underside black, with Brussels brown margins, reticulate rugose, margins nude; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, very heavily nubilated with brownish granules; algal layer 20 μ thick, nearly continuous, cells 5–6 μ in diameter; medulla K–, C–, KC–, 80 μ thick, of predominantly longitudinal hyphae, 2.5 μ in diameter, thinwalled, moderately closely woven with some oblique or vertical hyphae; lower cortex deep brown, 15 μ thick, pseudoparenchymatous from longitudinal hyphae about 3 μ in diameter, extending to the upper surface of the lobe at the margin.

ST. HELENA: corticole, *J. C. Melliss*, at Kew.

PARMELIA (AMPHIGYMNIA) **Braunii** Dodge, sp. nov.

Type: Tanganyika, without locality, corticole, growing over hepatics, *Braun*, Inst. Amani 8603, det. *P. perlata* (L.) Nyl. by Hesse in E. African Herb.

Thallus 8 cm. diametro, roseo-alutaceus aut vinaceo-alutaceus, lobis peripheric is 30 × 10–15 mm., apicibus rotundatis, ciliatis, ciliis 1–1.5 mm. longitudine, lobulis lateralibus 1–5 mm. longitudine, 1–3 mm. latitudine, marginibus fimbriatis, isidiosis, superficies laevis centro isidiosa, isidiis brevibus, fragillimis; infra niger, minute reticulatim rugulosus, marginibus nudis laevibus, nitidis, brunneis; cortex superior 10 μ crassitudine, fastigiatus, hyphis 4 μ diametro, granulis brunneis nubilatis; stratum algarum 10 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 3–4 μ diametro; medulla K–, C rosea, KC rosea, 60 μ crassitudine, hyphis longitudinalibus, compacte intertextis, 4–5 μ diametro, granulis brunneis nubilatis; cortex inferior brunneus, gelifactus, 7–9 μ crassitudine, pseudoparenchymatice fastigiatus, lumina ca. 1 μ diametro.

Thallus 6 cm. in diameter, pinkish buff to vinaceous buff (1957), in type, between ecru olive and dark olive buff, shading toward wood brown on some lobes in the more recently collected *Dale L53* p. p. min.; peripheral lobes 30 mm. long, 10–15 mm. wide, tips rounded, ciliate, cilia 1–1.5 mm. long, moderately close, lateral lobes variable from 3 mm. wide, 5 mm. long to 1 mm. wide, 1–2 mm. long, margins fimbriate, isidiose; surface smooth isidia in the center of the thallus varying from verrucae to papilliform and rarely dichotomous, very fragile; underside black, shining, minutely reticulate rugulose in the center with groups of moderately dense, short, slender rhizinae, stouter and densely branched at the tips when forming holdfasts in contact with the bark, margins nude, more minutely reticulate rugulose to smooth, nitid, Brussels brown; upper cortex 10 μ thick, fastigiate, hyphae 4 μ in diameter, heavily nubilated with brownish granules; algal layer 10 μ thick, of discrete colonies of *Trebouxia*, cells 3–4 μ in diameter; medulla K–, C pink, KC pink, 60 μ thick, of longitudinal hyphae, very closely woven, 4–5 μ in diameter, very heavily nubilated with brownish granules; lower cortex 7–9 μ thick, of gelified fastigiate pseudoparenchyma, lumina about 1 μ in diameter, brownish.

From the color of the more recently collected *Dale L53* p. p. min., perhaps this species belongs in the Subflavescentes section.

UGANDA: Bunyoro, Busingiro, 1125 m., on Jacaranda tree, *I. R. Dale* p. p. min., at Kew.

TANGANYIKA: without locality, *Braun*, B. L. Inst. Amani 8603, type, sub *P. perlata* det. Hesse, 8604 sub *P. tinctorum* det. Hesse, both in E. African Herb.

PARMELIA (AMPHIGYMNIA) Manni Dodge, sp. nov.

Type: Ilha Principe, *Gustavo Mann*, at Kew.

Thallus ca. 17 cm. diametro, obscure olivaceo-alutaceus, lobis peripheric is 40 mm. longitudine, flabellatis, inferne 6 mm. latitudine, superne ad 30 mm., marginibus crenatis, crispatis ciliatisque, ciliis 0.5–1.5 mm. longitudine, laevibus, opacis, centralibus rotundatis, 5–10 mm. diametro, marginibus isidiosis, isidia longa, coralloidea, superne isidiosus, isidiis simplicibus brevioribusque; inferne niger, marginibus nudis, brunneis; cortex superior 8 μ crassitudine, pseudoparenchymaticus, cellulis leptodermeis, 3 μ diametro, irregulariter dispositis; stratum algarum 30 μ crassitudine, subcontinuum, cellulis 6 μ diametro; medulla K–, C rosea, KC–, 60 μ crassitudine, hyphis 2 μ diametro, longitudinalibus, confertim contextis, granulis griseis nubilatis; cortex inferior 8μ crassitudine, nigrobrunneus, pseudoparenchymatice fastigiatus, cellulis pachydermeis.

Apothecia 6–7 mm. diametro, stipitibus 1.5–2 mm. altitudine, 1.5 mm. diametro, longitudinaliter sulcatis, marginibus lobulatis, lobulis ad 2 mm. longitudine, 0.1–0.2 mm. latitudine, laceratis, coralloideis cum isidiis; excipulo scrobiculato, coralloideis cum isidiis in rugis, disco concavo, castaneo; cortex amphithecialis 30 μ crassitudine, fastigiatus, hyphis 3 μ diametro, septatis, luminibus 1.5 μ diametro; stratum algarum 20 μ crassitudine, subcontinuum, granulis brunneis nubilatum; medulla hyphis confertim contexta laxius sub strato algarum; stratum algarum sub parathecio coloniis discretis *Trebouxiae*, 15 μ diametro; parathecium 20 μ crassitudine, pseudoparenchymatice fastigiatum; hypothecium 20 μ crassitudine, hyphis tenuibus periclinalibus; thecium 65 μ altitudine; asci clavati, 45 $\times$ 13 μ, apicibus juventute incrassatis; ascosporae ellipsoideae, 11–13 $\times$ 7–8 μ, episporio tnui.

Thallus about 17 cm. in diameter, between dark olive buff and deep olive buff, peripheral lobes 40 mm. long, flabellate, 6 mm. wide below, expanding to 30 mm. above, margins crenate, crisped, ciliate, cilia 0.5–1.5 mm. long, surface smooth, opaque; central lobes rounded, 5–10 mm. in diameter, margins isidiose, isidia long coralloid, upper surface with shorter isidia mostly simple; underside black, with Dresden brown nude margins; upper cortex 8 μ thick, pseudoparenchymatous, cells thinwalled, 3 μ in diameter, irregularly arranged; algal layer 30 μ thick, nearly continuous, cells 6 μ in diameter; medulla K–, C pink, KC–, 60 μ thick, of closely woven, longitudinal hyphae, 2 μ in diameter, very heavily nubilated with grayish granules; lower cortex dark brown, 8 μ thick, of thickwalled fastigiate pseudoparenchyma.

Apothecia 6–7 mm. in diameter, stipes 1.5–2 mm. tall, 1.5 mm. in diameter, longitudinally sulcate, margins lobulate, lobules up to 2 mm. long, 0.1–0.2 mm. wide, lacerate, growing out as coralloid isidia, exciple scrobiculate with coralloid isidia long the ridges, disc remaining concave, burnt sienna to chestnut; amphithecial cortex 30 μ thick, fastigiate, hyphae septate 3 μ in diameter, lumina 1.5 μ; algal layer 20 μ thick, nearly continuous, very heavily nubilated with brownish

granules; medulla moderately closely woven, looser next the algal layer, heavily nubilated with brownish granules; algal layer under the parathecium of discrete colonies of *Trebouxia,* 15 μ in diameter; parathecium 20 μ thick, of fastigiate pseudoparenchyma; hypothecium 20 μ thick, of very slender, periclinal hyphae, not staining in the lower half; thecium 65 μ tall; paraphyses slender, septate, dichotomous above the asci, branches moniliform, ending about 15 μ below the surface of the pale brown epithecial gel; asci clavate cylindric, 45 $\times$ 13 μ, tips and upper half of wall thickened when young; ascospores ellipsoid, 11–13 $\times$ 7–8 μ, with a thin epispore.

ILHA PRINCIPE: *Gustavo Mann,* type, at Kew.

PARMELIA (AMPHIGYMNIA) **Stuhlmanni** Dodge, nom. nov.

Parmelia nitens v. *isidiosa* Müll. Arg., Bot. Jahrb. [Engler] **20**:255. 1894.

Type: Tanganyika, Usambara, Ririre Karapo, *Stuhlmann 3301.*

Thallus about 13 cm. in diameter, citrine drab in the center, shading to deep olive buff toward the margins and vinaceous buff in the outer 3 mm., lobes rounded, 10–15 mm. wide, 10 mm. long, margins smooth, to shallowly crenate, not or only slightly isidiose, eciliate, center densely isidiose, isidia simple, short, easily breaking off and the surface appearing coarsely granular under low magnification, upper surface coarsely rugose, rimulose areolate, peripheral lobes smooth and subnitid; underside black, margins buckthorn brown, shining, minutely reticulate rugulose, rhizinae in dense groups near the center, less than 1 mm. long, stout, forming disciform holdfasts about 0.5 mm. in diameter, sometimes concrescent, some growing down from folds and failing to make contact with the substrate, more slender, 2–3 mm. long with acute tips; upper cortex 12 μ thick, of fastigiate thinwalled pseudoparenchyma, cells 4 μ in diameter, nubilated with brownish granules; algal layer 25 μ thick, of single cells 9–10 μ in diameter and small colonies of *Trebouxia* in a nearly continuous layer; medulla K–, C–, KC–, 80 μ thick, of moderately closely woven longitudinal hyphae with some vertical hyphae, 3 μ in diameter, lumina 2 μ, not nubilated; lower cortex black, 12 μ thick, of gelified fastigiate pseudoparenchyma, cells thickwalled, lumina about 2 μ in diameter.

Apothecia submarginal, 13 mm. in diameter, stipe 1 mm. tall, 3 mm. in diameter, smooth; margin entire to slightly crenulate, inflexed; exciple white reticulate and slightly rimulose below, disc chestnut; amphithecial cortex 55 μ thick, fastigiate, hyphae septate, 5–6 μ in diameter, lumina 1.5–2 μ; algal layer of discrete colonies, nearly continuous in places; medulla closely woven; algal layer under the parathecium 30 μ thick, continuous with a few cells deeper in the medulla; parathecium 20 μ thick, of thickwalled fastigiate pseudoparenchyma; hypothecium 40 μ thick, of periclinal, closely woven hyphae; thecium 60 μ tall; paraphyses septate, dichotomous above the asci, branches moniliform, tips not thickened, reaching the surface of the brownish epithecial gel; asci clavate, 35 $\times$ 15 μ, 8-spored, walls thin, tips thickened when young; ascospores ellipsoid, 11 $\times$ 7 μ, with a moderately thick epispore.

Holst 710 is rather fragmentary with most of the isidia broken off, but it is fertile. It was determined *P. perlata* v. *olivaria* Ach. by Müller Argau, probably

before he published *P. nitens* v. *isidiosa*. The microscopic characters of the apothecia show this taxon to be distinct from *P. nitens* Müll. Arg.

TANGANYIKA: Usambara, *C. Holst 710*, at Kew.
SOUTHERN RHODESIA: Matapos District, 1610 m., probably on sandstone (quartz grains tangled with the rhizinae), *Frederick Eyles 1178*, at Kew.

PARMELIA (AMPHIGYMNIA) LOBULASCENS Steiner, v. ISIDIOSISSIMA Dodge, Ann. Missouri Bot. Gard. 40:375. 1953.

Type: Sierra Leone, Sefadu (Gbense), on trunk of *Elaeis guineensis*, *P. Adames*, com. F. C. Deighton M4754, at Kew.

Thallus about 10 cm. in diameter, 135–150 μ thick, pale olive buff, K faint yellow, irregularly lobed, some lobes rounded up to 15 mm. broad, margin smooth, crisped, sinuses irregularly excised, eciliate, other lobes only 3–5 mm. broad, more erect, margins isidiose of lobulate isidia from granular to coralloid, up to 2 mm. tall, 0.5 mm. in diameter, non isidiose lobules very rare, about 1 mm. long, 0.5 mm. wide, somewhat constricted at the base; underside black, opaque, minutely rugulose; rhizinae about 1 mm. long, black, confined to central portion of thallus, broader lobes shading through chestnut to light brown at the margin, nearly smooth and shining, narrower lobes either rugulose and black to the margin or abruptly white in a narrow zone 1 mm. wide; upper cortex 25 μ thick of thin-walled fastigiate pseudoparenchyma, cells about 6 μ in diameter, smaller toward the outside; algal layer 15–25 (–40) μ thick, cells 6–8 μ in diameter, heavily nubilated; medulla K–, C–, KC–, 65 μ thick, of loosely woven, thickwalled hyphae 3 μ in diameter, more longitudinal and compactly woven below, interstices nearly filled with grayish granules; lower cortex black, 15–25 μ thick, pseudoparenchymatous.

SIERRA LEONE: Sefadu, Gbense, on trunk of *Elaeis guineensis*, *P. Adames*, com. F. C. Deighton M4754, type, at Kew.
NIGERIA: *Charles Barter 503*, fragment, Nigher Exp. in Leighton Herb. at Kew.

PARMELIA (AMPHIGYMNIA) PSEUDOTINCTORUM des Abbayes, Bull. Inst. Franç. Afrique Noire 13:973. 1951.

Type: Côte d'Ivoire, Mt. Tonkoni (cercle de Man), 1150 m., *des Abbayes*; Mankono and Seguela (cercle de Geguela), *des Abbayes*, all on granite.

Thallus up to 15 cm. in diameter, deep olive buff in the center, a little lighter toward the margins, peripheral lobes rounded, 5–15 mm. wide, subimbricate, margins ascending, somewhat crisped, crenulate, smooth, becoming minutely isidiose toward the base; upper surface smooth to coarsely rugose in the center, very densely isidiose, isidia simple or coralloid, many papilliform, especially toward the marginal lobes where isidia are very rare; underside black in the center to Brussels brown at the margin, rhizinae stout, 1 mm. long or less, in scattered groups in the center of the lobes; upper cortex 15 μ thick, of fastigiate thickwalled pseudoparenchyma, cells 5–6 μ in diameter, outer cells up to 12 μ long, lumina 1 μ in diameter, outer half somewhat nubilated with brownish granules; algal layer of discrete colonies of *Trebouxia*, 15 μ in diameter, cells 6–7 μ in diameter; medulla K–, C pink, KC–, 65 μ thick, of closely woven longitudinal hyphae, 4 μ in diameter, heavily nubilated

with grayish brown granules, less so in the lower 10 μ; lower cortex black, 15 μ thick, of pseudoparenchyma from longitudinal hyphae 3–4 μ in diameter with very thick dark brown walls.

Apothecia rare, stipe 1 mm. tall, 4 mm. in diameter, slightly longitudinally rugose, up to 10 mm. in diameter, margin and exciple smooth, minutely white reticulate, splitting radially once or twice when old, disc Dresden brown; amphithecial cortex 25 μ thick, fastigiate, gelified, outer half nubilated with brownish granules; algal layer 25 μ thick, continuous; medulla loosely woven, somewhat more compact above; algal layer under the parathecium 25 μ thick, continuous; parathecium 30–35 μ thick, of periclinal, thinwalled hyphae; hypothecium not well differentiated, about 5 μ thick, hyphae thickwalled; thecium 70 μ tall; paraphyses slender, septate, once dichotomous above the asci, branches submoniliform, tips narrowly clavate reaching the surface of the brownish epithecial gel; asci clavate becoming ellipsoid, 30 $\times$ 13–14 μ, wall and tip about 3 μ thick when quite young, then tips thicken to 6–7 μ with a slightly mamillate protoplast, thinning at maturity; ascospores distichous, ellipsoid, 8–11 $\times$ 6–7 μ with moderately thick epispore.

The description of apothecia is based on *Roberty 12673*. *Zenker 1345* is KC pink.

SIERRA LEONE: Gbense, Sefadu, on trunk of *Elaeis guineensis, P. Adames,* com. F. C. Deighton M4753; Kori, Njala, on branch of *Funtumia africana, F. C. Deighton M5639,* at Kew.

CÔTE D'IVOIRE: Triangle aride de Toumodi, Bouallé sur du Boka de Titièkro, on bark, *G. Roberty 12673,* fertile, Conserv. Bot. Genève

NIGERIA: *Charles Barter 503,* Niger Exp. in Leighton Herb. at Kew.

CAMEROUN: Bipinde, *G. Zenker 1345,* in Dodge Herb.

FERNANDO PO: Timber bay, on trees, *Charles Barter,* Niger Exp. at Kew.

ILHA PRINCIPE: *Charles Barter, 1894, 1932,* Niger Exp. at Kew.

ANGOLA: Nordeste da Lunda, Dundo, exploracões da Companhia de Diamantes de Angola, near Rio Luachimo, 750 m., on branches of tall trees of gallery wood, *J. Gossweiler 13928,* at Kew; Loanda, Cazengo, *J. Gossweiler 4793,* at Kew.

UGANDA: Mt. Elgon, 1290 m., *W. Small J19* p. p., at Kew.

Var. **perrugosa** (des Abb.) Dodge, comb. nov.

Parmelia pseudotinctorum f. *perrugosa* des Abb., Bull. Inst. Franç. Afrique Noire 13:973. 1951.

Type: Guinée Française, Fouta Djalon, à Dalaba (cercle de Mamou), saxicole, 1200 m., *H. des Abbayes.*

Surface more rugose, isidia coralloid, more dense in the center of the thallus.

UGANDA: Kigezi, Mafuga, 2580 m., saxicole, *I. R. Dale L52, L68* p. p. min.

Parmelia (Amphagymnia) **meiosperma** (Hue) Dodge, comb. nov.

Parmelia internexa f. *meiosperma* Hue, Nouv. Arch. Mus. [Paris] IV. 1:185. 1899.

Type: Réunion, Mafate, *Rodrigues,* substrate not given.

Thallus 7 (–22.5) cm. in diameter, pinkish buff in center, shading to olive buff on the margins, center coarsely rugose, lobes rounded, imbricate, 10–15 mm. wide, isidiose, isidia simple or forked, short, fragile, scars resembling pseudocyphellae, marginal isidia coarser, 1 mm. long 0.2–0.4 mm. in diameter, the wider somewhat flattened, tips pale, not becoming sorediose, peripheral lobes rounded, 10–15 mm.

wide, about 10 mm. long, some smooth, coarsely crenate with a very narrow black margin, others dentate with isidial initials, 0.1–0.2 mm. long, without narrow black margin; underside black, minutely reticulate rugulose, shading to antique brown at the margins, rhizinae stout, confined to scattered areas in the center of the thallus, short, expanding at the tips to irregular flattened holdfasts; upper cortex 10–13 μ thick, of fastigiate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with greenish brown granules, covered by a thin amorphous layer 2 μ thick; algal layer 20 μ thick, of close discrete colonies of *Trebouxia,* cells 6–9 μ in diameter, some disappearing and leaving lacunae; medulla K–, C pink, KC pink, 115–145 μ thick, of longitudinal thickwalled hyphae 3 μ in diameter, heavily nubilated with grayish granules and very closely woven in the upper portion, very loose and arachnoid without granules in the lower 35 μ; lower cortex black, 13 μ thick, pseudoparenchymatous from longitudinal hyphae, cells 6–7 μ in diameter.

Apothecia 2–5 mm. in diameter, sessile, cupuliform becoming flattened, margin and exciple densely isidiose, disc dark rufous, imperforate; amphithecial cortex 50 μ thick, of fastigiate pseudoparenchyma, cells 6–8 μ; algal layer 30–40 μ thick, of close but discrete colonies; medulla very loosely woven, more compact next the algal layers; algal layer under the parathecium 30–40 μ thick, continuous; parathecium 30 μ thick, irregularly fastigiate pseudoparenchyma with thin walls, more deeply staining in the upper half; hypothecium 20 μ thick, of loosely woven, slender, periclinal hyphae; thecium 80–90 μ tall; paraphyses 1.5 μ in diameter, septate, branched above the asci, tips 3 μ in diameter, ending about 8 μ below the surface of the pale rufescent epithecial gel; asci 64–80 $\times$ 20–22 μ, tip very thick, protoplast long mamillate when young, 6–8-spored; ascospores ellipsoid, 18–20 (–21) $\times$ 10–11 μ.

Our material is sterile except for immature apothecia on the Ayres specimen from Mauritius and the above description of the apothecia is largely a translation of Hue's description amplified by characters observable in the Ayres collection. *Grote 8605* is a thinner plant, although 10 cm. in diameter with the medulla 75 μ thick, more loosely woven with some vertical hyphae, scarcely nubilated with granules, lower cortex only 6 μ thick. While Taylor identified Wight's collection from Mauritius as *P. saccatiloba* Taylor, type from Pitcairn Island, (see p. 180) it is a thinner plant, smaller in most microscopic characters and the medulla reacts pink with C and KC. *P. saccatiloba* is negative to these reagents.

MAURITIUS: without locality, *Dr. Wight* in Taylor Herb. sub *P. saccatiloba* Tayl., later det. *P. praetervisa* Müll. Arg. by Müller Argau, and *P. latissima* by C. J. Sprague, at Farlow Herb.; duplicate? at Kew in Herb. Hookerianum; *Sieber* sub *P. latissima-sorediata-isidiophora* ex Herb. Sbarbaro at Farlow Herb.; on the Bruce, on trees, *Ayres* at Kew; Ponce, *Ayres 16* and 2 other collections, at Kew.

COMORO ISLANDS: Anjouan (Johanna) Island, 400 m., truncicole, *J. M. Hildebrandt 1866a,* at Kew.

RODRÍGUEZ ISLAND: *I. B. Balfour 2249,* Venus Transit Exp., at Kew.

MADAGASCAR: E. Imerina, Andrangolaoka, *J. M. Hildebrandt 2148,* sub *P. perlata* v. *platyloba* Müll. Arg. det. Müller Argau; Nossi-bé, *J. M. Hildebrandt* May 1879, sub *P. perlata* v. *coralloidea* Mey. & Fw., both ex Herb. Sbarbaro at Farlow Herb.

TANGANYIKA: Kilimanjaro, Bismarck Hill, 1000 m., *Grote* ex herb. E. African Agr. Res. Inst. Amani 8605 sub *P. tinctorum* Despr. in E. African Herb.; Usambara, growing over orchid roots, *C. Holst 710* p. p. at Kew.

Var. **Ecklonii** Dodge, var. nov.

Type: Cape of Good Hope, corticole, growing over hepatics, *Ecklon* ex herb. Sonder sub *P. perlata* Ach. in Tuckerman Herb. at Farlow Herb.

Thallus ca. 7 cm. diametro, cremeo-alutaceus, rugosus, lobis peripheric is semiorbicularibus, 12–15 mm. diametro, marginibus crenatis, sinibus obtusis aut rotundatis, lobis centralibus parvioribus, marginibus dentatis vel minute isidiosis, superficie dense isidiosa, isidiis brevibus, simplicibus; infra niger, apocus, marginibus argillaceis, nudis; rhiznae catervatim in centro thalli disposita, crassae, 1 mm. longitudine; cortex superior 13–15 μ crassitudine, fastigiatus, cellulis cylindricis, 4 μ diametro, granulis viridi-brunneis nubilatis; stratum algarum 30 μ crassitudine, coloniis discretis parvis *Trebouxiae*, cellulis 6 μ diametro; medulla K–, C rosea, KC–, 100–130 μ crassitudine, hyphis longitudinalibus, in parte superiori dense, infra laxius contextis; cortex inferior 10–15 μ crassitudine, fastigiatus.

Thallus about 7 cm. in diameter, cream buff, very coarsely rugose, peripheral lobes smooth, nearly semicircular, 12–15 μ wide, 10 mm. long, margins crenate, sinuses obtuse or rounded, central lobes somewhat smaller, margins often dentate or minutely isidiose, surface densely isidiose, isidia short, slender, simple, a few forked near the tips; underside black, opaque, margins clay color to tawny olive, minutely reticulate rugulose; rhizinae stout, about 1 mm. long, in close groups on central portion, with a whorl of short branches at the tips forming the holdfasts; upper cortex 13–15 μ thick, fastigiate, cells cylindric, 4 μ in diameter, heavily nubilated with greenish brown granules, formed by dichotomies of medullary hyphae in the algal layer; algal layer 30 μ thick, of single cells 6 μ in diameter and small colonies of *Trebouxia*, between vertical medullary hyphae; medulla K–, C deep pink, KC–, 100–130 μ thick, of very closely woven longitudinal hyphae in the upper 30 μ, looser and less regular below; lower cortex 10–15 μ thick, fastigiate, black toward the center, almost hyaline at the margin. No apothecia seen.

Anatomically this variety agrees quite closely with *P. meiosperma* but differs in the medulla being KC negative and in the structure of the lower cortex.

SOMALILAND: Libah Mele Mt., 1675 m., above Buja Soldan, 10° 20′ N., 43° E., on *Grewia ?* twigs, *J. B. Gillett 4699* p. p., Abyssinia-Somaliland Boundary Commission, at Kew.

TANGANYIKA: Mulinda forest, s.e. of Tukuyu (New Langenburg), 900 m., on trees growing over roots of *Rangaenis muscicola* (orchid), *A. Stolz 2577c*; Ufipa, Nkunde-Chapota, 2550 m., on roots of *Diaphananthe pulchella* on *Acacia*, 7 m. up in dense shade, *A. A. Bullock 1962* p. p. min., International Red Locust Control Service, at Kew.

NORTHERN RHODESIA: Abercorn, growing over roots of *Crystorchis praetermissa* on *Brachystegia taxifolia* in dense shade of crown, *A. A. Bullock 2104 pars*, International Red Locust Control Service, at Kew.

CAPE OF GOOD HOPE: hepaticole, *Ecklon*, ex herb. Sonder in Tuckerman Herb. sub *P. perlata* Ach. at Farlow Herb.

PARMELIA (AMPHIGYMNIA) HABABIANA Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] **29**:288/416. 1931.

Parmelia abessinica v. *sorediosa* Müll. Arg., Flora **68**:501. 1885.

Type: Ethiopia, Habab, ramulicole, *J. M. Hildebrandt 310* p. p.

Thallus 3 cm. in diameter, attached along the upper surface of the twig, the

rest free, between wood brown and dark olive buff (1957), lobes rounded, 12–13 mm. broad, margins crisped with a more or less continuous band of powdery soredia and 2–3 rows of discrete, hemispheric powdery soredia 0.3–0.5 mm. in diameter, 1–2 mm. inside the margins, never close and confluent, very rare elsewhere on the upper surface, cilia sparse, rather fragile, up to 1 mm. long; surface rugose to shallowly subscrobiculate, partly rimulose along the ridges with a few punctate pseudocyphellae; underside black along the center, then abruptly tawny or darker to the margin, minutely reticulate rugulose; rhizinae few, stout in the center of the thallus, about 2 mm. long, tips pale; upper cortex 25 μ thick, of fastigiate pseudoparenchyma, protoplasts spherical, 2 μ in diameter, covered by an amorphous layer 5–6 μ thick, nubilated with pale brown granules; algal layer of discrete colonies of *Trebouxia,* 15 μ in diameter, cells 6–7 μ; medulla K–, C–, KC–, 130–200 μ thick, upper 50 μ of closely woven, predominantly longitudinal hyphae with an occasional algal cell, the lower 30 μ also closely woven, the middle very arachnoid with large air spaces, hyphae 4 μ in diameter, not nubilated; lower cortex 25 μ thick, of fastigiate pseudoparenchyma, cells 6–7 μ in diameter, somewhat irregularly arranged with thick, dark brown walls.

Apothecia 2 mm. in diameter, substipitate, margin powdery sorediose, soredia 30 μ in diameter, exciple smooth, disc Sanford's brown to auburn, concave; amphithecial cortex 50–55 μ thick, of gelified fastigiate pseudoparenchyma, lumina about 1 μ in diameter; algal layer of discrete colonies about 15 μ in diameter; medulla closely woven; algal layer under the parathecium 30 μ thick, continuous; parathecium 50 μ thick, of gelified fastigiate pseudoparenchyma; hypothecium 15 μ thick, of slender, closely woven periclinal hyphae; thecium 65 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches submoniliform, tips pyriform 9 $\times$ 3 μ, ending about 5 μ below the surface of the brownish epithecial gel; asci clavate, 65 $\times$ 15 μ, thickwalled; ascospores ellipsoid, 13–16 $\times$ 6–7 μ.

In the portion of the apothecium sectioned, the thecium is somewhat moribund, the measurements of the ascus were taken from a young ascus with the protoplast just beginning to cleave. The spores measured were mature, adherent to the surface of the epithecial gel, although there is a possibility that they may have been foreign spores. *Hildebrandt 310* p. p. is stated by Gyelnik to have come from Hababb, but the two collections of this number available to me were both from Bagla, both ramulicole and determined by Müller Argau as *P. abessinica* v. *sorediosa.* Another specimen from Bagla without collector's number, also identified by Müller Argau, is in better condition and fertile and has been used in writing the above description of apothecia. *Pegler 1231* is somewhat paler with the underside of the margins warm buff.

SOMALILAND: Libah Mele Mt. above Buja Soldan 10° 20′ N., 43° E., 1675 m., on *Grewia?* sp., *J. B. Gillett 4697*; ridge southeast of Andoba, 9° 59′ N., 43°04′ E., 1740 m., on *Euphorbia* trunk, *J. B. Gillett 4607* p. p., both Abyssinia-Somaliland Boundary Commission at Kew.

ETHIOPIA: Bagla, 2415 m., ramulicole, *J. M. Hildebrandt 310* p. p. and another without collector's number, both sub *P. abessinica* v. *sorediosa* Müll. Arg., det. Müller Argau, at Farlow Herbarium; without locality data nor collector, 25 VII 1957, C.B.E.E., at Kew; Haramat District, near Geraz on *Euphorbia Collquall, W. P. Schimper,* Iter Abyssinicum

Sect. II, no. 1396 sub *P. perlata* v. *coniocarpa* Fw. at Kew (see note under *P. Allenii* Dodge, p. 151).

KENYA: buffalo country south of Narossaro (Narosura?), 1610–2250 m., corticole, *Anita Grosvenor Curtis 700*, in Dodge Herb.

UGANDA: Kigezi, Mafuga, 2415 m., on trees, *I. R. Dale L8, L50* p. p. min., at Kew.

SOUTH AFRICA: Kentani District, 320 m., on *Acacia horrida, Alice Pegler 1231* p. p., lower right plant, at Kew.

PARMELIA (AMPHIGYMNIA) **imerinensis** Dodge, sp. nov.

Type: Madagascar, East Imerina, *J. M. Hildebrandt*, Dec. 1880, corticole, ex herb. Sbarbaro, at Farlow Herb.

Thallus ad 15 cm. diametro, obscure olivaceo-alutaceus, lobis peripheric rotundatis, 15 mm. latitudine, 20 mm. longitudine, crenatis, sinibus non excisis, crispatis, laevibus, subnitidis, imbricatis; lobis centralibus minoribus, marginibus lateralibus saepe revolutis, terminalibus adscendentibus, crispatis, lobulatis, sinibus excisis, lobulis 1 × 1 mm., capitatis cum soraliis 1–1.5 mm. diametro, non confluentibus; supercicies minute rimuloso-areolata, sparsis cum soraliis 0.5 mm. diametro, eciliatus; infra niger, marginibus cinnamoneo-alutaceis umbrinisve, rhizinibus brevibus, 0.5 mm. longitudine; cortex superior 30 μ crassitudine, fastigiatus, cellulis exteris 15 × 5 μ, interis isodiametricis; stratum algarum 15 μ crassitudine, continuum granulis griseo-brunneis nubilatum; medulla K flava, C–, KC–, 80 μ crassitudine hyphis pachydermeis longitudinalibus, 3 μ diametro, irregulariter nubilatis, compacte intertextis; cortex inferior 7–10 μ crassitudine, gelifactus, cellulis isodiametricis 7–10 μ. Apothecia non visa.

Thallus at least 15 cm. in diameter, probably larger, deep olive buff, peripheral lobes rounded, about 15 mm. wide, 20 mm. long, deeply crenate, sinuses not excised, margins somewhat crisped, surface smooth, subnitid, imbricate; central lobes smaller, lateral margins often revolute, terminal margins ascending, very crisped and lobulate with excised sinuses, lobules 1 mm. long and wide, bearing large capitate soralia 1–1.5 mm. in diameter, never confluent along the margins; surface opaque, minutely rimulose areolate, with scattered patches of soralia up to 0.5 mm. in diameter, wholly eciliate; underside black shading to Saccardo's umber to tawny olive or cinnamon buff at the margins; rhizinae stout, less than 0.5 mm. long; upper cortex 30 μ thick, fastigiate, outermost cells 15 × 5 μ, others isodiametric, partly crushed and invaded by proliferating algal cells and small colonies in the lower 10 μ; algal layer 15 μ thick, continuous, very heavily nubilated with brownish granules, cells 4–5 μ in diameter; medulla K slowly deep yellow, C–, KC–, 80 μ thick, of longitudinal, thickwalled hyphae, 3 μ in diameter, closely woven with thin air spaces under the algal layer; heavily but irregularly nubilated; lower cortex 7–10 μ thick, of a single layer of cells, highly gelified. Apothecia not seen.

This species seems related to *P. cristifera* Taylor from India, (see p. 178), having the same chemical reactions and soredia on the upper surface as well as marginal, but it is smaller in all dimensions and has a different structure of the upper cortex. The Mauritius specimen consists of parts of two thalli, one growing on a small branch, consisting of central lobes, the other growing on a much larger branch or small trunk, between maize yellow and cream color, has only the peripheral lobes; both without superficial soredia.

MADAGASCAR: East Imerina, *J. M. Hildebrandt,* Dec. 1880, sub *P. perlata* v. *olivaria* det. Müller Argau, ex herb. Sbarbaro, at Farlow Herb.
MAURITIUS: Reduit, *G. Orian 7,* at Kew.
SOUTH AFRICA: British Kaffraria, *T. Cooper 1513,* sub *P. latissima* v. *sorediata* Nyl., det. Müller Argau, at Kew.

PARMELIA (AMPHIGYMNIA) PEDICELLATA Steiner, Sitzungsber. K. Akad. Wiss. Wien, Math. Naturw. Cl. **106**:1:214. 1897.

Type: Kenya, Machakos, *Liechtenstein.*

Thallus 8 cm. or more in diameter, ashy glaucous becoming light buff, peripheral lobes semicircular, about 5 mm. in diameter, margins crisped, crenate, sparsely ciliate, cilia about 2 mm. long, rarely forked, surface smooth, central lobes capitate sorediate, soon confluent, soralia confined to the margins, very crisped, surface reticulate rimulose, rugulose toward the center; underside reticulate rugulose, black with scattered groups of long stout rhizinae, margins nude sometimes black to the margin, sometimes shining antique brown; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter, protoplasts about 2 μ, nubilated with brownish granules in the outer portion; algal layer of scattered colonies of *Trebouxia,* about 15 μ in diameter; medulla K yellow, C–, KC more intense yellow, 55 μ thick, of rather closely woven longitudinal, thickwalled hyphae, 5–6 μ in diameter; lower cortex black, 30 μ thick, of thickwalled fastigiate pseudoparenchyma, cells 6 μ in diameter.

Apothecia urceolate 6–10 mm. in diameter, stipe 2 mm. tall, 3 mm. in diameter, longitudinally deeply sulcate; margin thin, sorediose; exciple reticulate rugose, subscrobiculate below, smooth above, disc chestnut, perforate; amphithecial cortex 11–16 μ thick, fastigiate, gelified, heavily nubilated with brownish granules; algal layer 55 μ thick, nearly continuous; medulla loosely woven; algal layer under the parathecium 40–60 μ thick, continuous; parathecium 15 μ thick, of relatively thinwalled, fastigiate pseudoparenchyma; hypothecium 15 μ thick, of slender periclinal, rather loosely woven hyphae; thecium 80 μ tall; paraphyses septate, dichotomous above the asci, branches submoniliform, tips clavate, reaching the surface of the brownish epithecial gel; asci clavate, about 55 $\times$ 15 μ, tips greatly thickened, protoplasts mamillate when young; ascospores ellipsoid, 13–19 (–20) $\times$ 7–10 μ (14–16 $\times$ 8–11 μ in our South African specimen), with a thick epispore.

UGANDA: Mt. Elgon, Jackson's Peak, 4580 m., on rocks at summit, *R. A. Dümmer 3397,* Dümmer-Maclennan Exp., sterile, at Kew.
SOUTH AFRICA: Kentani District, *Alice Pegler,* ex S. African Mus. 21 July 1917, fertile, at Kew.

Var. **isidiosa** Dodge, var. nov.

Type: Uganda, Bugishu, Bulambuli, 2900 m., in bamboo forest, *A. S. Thomas 549* p. p. min.

Thallus 12 cm. diametro, olivaceo-alutaceus vel pallidior, lobis periphericis 20 mm. longitudine, 15 μ latitudine, apicibus rotundatis vel subcrenatis, sparsim breveriterque ciliatis, lobis centralibus isidiosis, isidiis simplicibus furcatisve, brevibus, tenuibus; infra niger, rhizinis brevibus, marginibus nudis, inter cinnamomeo-alutaceis et avellaneis; cortex superior 8 μ crassitudine, fastigiatus, cellulis 8 $\times$ 5 μ,

leptodermeis, granulis brunneis nubilatis; stratum algarum 15–16 μ crassitudine, continuum, cellulis 7–8 μ diametro; medulla K flava, C–, KC intense flava subaurantiacave, 60 μ crassitudine, hyphis pachydermeis longitudinalibus, densis, 5–6 μ diametro, irregulariter granulis dilute brunneis nubilatis; cortex inferior 15 μ crassitudine, nigro-brunneus, pseudoparenchymaticus ex hyphis longitudinalibus. Apothecia non visa.

Thallus about 12 cm. in diameter, olive buff to pale olive buff, peripheral lobes 20 mm. long, 15 mm. wide, tips rounded or very slightly crenate, sparingly very short ciliate, isidia abundant in the central portion, rare on peripheral lobes, simple or forked at the tips, very short and slender; underside black, short rhizinose, margins nude, between cinnamon buff and avellaneous; upper cortex 8 μ thick, fastigiate, a single layer of cells 8 $\times$ 5 μ, thinwalled, slightly nubilated with brownish granules; algal layer 15–16 μ thick, continuous, cells 7–8 μ in diameter; medulla K yellow, C–, KC intense yellow verging on orange, 60 μ thick, of moderately closely woven longitudinal hyphae, 5–6 μ in diameter, thickwalled, heavily but irregularly nubilated with pale brownish granules; lower cortex 15 μ thick, dark brown, pseudoparenchymatous from moderately thickwalled longitudinal hyphae. Apothecia not seen.

UGANDA: Bugishu, Bulambuli, 2900 m., in bamboo forest, *A. S. Thomas 549* p. p. min. at Kew.

PARMELIA (AMPHIGYMNIA) **nigrireagens** Dodge, sp. nov.

Type: Uganda, Western Province, Toro District, Ruwenzori, Kikandara, 3500 m., ramicole, *H. A. Omaston 3766c*, at Kew.

Thallus 5 cm. diametro, inter viridis Theae et griseus mineralis, K flavo-aurantiacus, lobis semiorbicularibus, 20 mm. diametro, crispatis, marginibus ciliatis, ciliis 1.5–2 mm. longitudine, crenatis, sinibus rotundatis, saepe capitato-sorediosis, mox confluentibus; infra niger, minute reticulatim rugulosus, marginibus laevibus, nitidis, rhizinis raris, crassis, brevibus; cortex superior 15–20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 5–6 μ diametro; stratum algarum coloniis sparsis discretis *Trebouxiae*, 15 μ diametro, cellulis 6–7 μ diametro; medulla K nigra, C–, KC nigra, 30 μ crassitudine, hyphis longitudinalibus dense intertextis, 2–3 μ diametro, non nubilatis; cortex inferior obscure brunneus, 8 μ crassitudine, stratum cellularum singularum isodiametricarum ex hyphis longitudinalibus. Apothecia non visa.

Thallus 5 cm. in diameter, between tea green and mineral gray, K yellow orange, lobes semicircular, 20 mm. in diameter, crisped, margins ciliate, cilia 1.5–2 mm. long, not dense, crenate with rounded sinuses, often capitate sorediate, soon confluent; underside black, minutely reticulate rugulose, shading to Dresden brown at the smooth, shining margins, rhizinae rare, short, stout, forming disciform holdfasts in contact with the substrate, otherwise longer, more slender, resembling the cilia; upper cortex 15–20 μ thick, of thinwalled, fastigiate pseudoparenchyma, cells 5–6 μ in diameter; algal layer of scattered discrete colonies of *Trebouxia*, 15 μ in diameter, cells 6–7 μ, with occasional cells deep in the medulla; medulla K black, C–, KC black, 30 μ thick, of longitudinal, closely woven hyphae 2–3 μ in diameter,

not nubilated; lower cortex dark brown, 8 μ thick, of isodiametric cells from longitudinal hyphae in a single layer.

ETHIOPIA: near Ankober, *Dr. Rohr,* sub *P. perforata* Ach. det. Müller Argau, at Kew.
CONGO: Mt. Kahusi, 2700 m., on twigs, *F. L. Hendrickx 4314* p. p. min. in E. African Herb.
UGANDA: North Mengo, 7 miles north of Nakasongola, 1255 m., ramulicole, *I. Langdale-Brown 343,* at Kew; Western Province, Toro District, Ruwenzori, Kikandara, 3500 m., ramicole, *H. A. Omaston 3766c,* type, at Kew.

PARMELIA (AMPHIGYMNIA) **Pooli** Dodge, nom. nov.

Parmelia proboscidea v. *sorediifera* Müll. Arg. Flora **67**:615. 1884.
Parmelia perlata f. *sorediifera* Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888-9:156. 1890, nom nud.; Müll. Arg., Flora **74**:382. 1891.
Imbricaria perlata v. *sorediifera* Jatta, Nuovo Giorn. Bot. Ital. N. S. 9:468. 1902.

Type: Not designated, Madagascar, *J. M. Hildebrandt,* and Australia, Clarendon, *Tepper* cited.

Thallus 12 cm. in diameter, drying light buff to cream color, peripheral lobes 10 mm. wide, rounded, margins very crisped, crenate with rounded sinuses, ciliate, cilia about 6 mm. long, mostly simple, some forked in the middle, close, surface smooth, subnitid; central lobes somewhat smaller, margins very crisped, capitate soraliate at first, soredia soon confluent in a continuous band, surface somewhat reticulate rimulose toward the center; underside black to the margins, or antique brown margins with a pale buff band below the soredia, very faintly rugulose, rhizinae rare, single, long, resembling cilia but stouter; upper cortex 15 μ thick, of thinwalled fastigiate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with brown granules; algal layer 15 μ thick, continuous, cells 6 μ in diameter, nubilated with hyaline granules; medulla K–, C red, KC–, 55 μ thick, of closely woven, very thickwalled longitudinal hyphae 3 μ in diameter, so heavily nubilated with hyaline granules that structure is visible only in very thin sections; lower cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 5 μ in diameter, somewhat irregularly arranged.

MADAGASCAR: Tananarive (Antananarivo), *W. Pool,* at Kew.

PARMELIA (AMPHIGYMNIA) SUBCILIARIS (Vainio) Dodge, Ann. Missouri Bot. Gard. **40**:377. 1953.

Parmelia nilgherrensis v. *subciliaris* Vainio, Hedwigia **37**:(40). 1898.

Type: Uganda, Mt. Ruwenzori, 0° 5′ S., 3000–3200 m., *G. F. Scott-Elliott 218.*

Thallus about 4 cm. in diameter, pale olive buff, lobes about 10 mm. broad, margins crenulate, upper surface K yellow, smooth to slightly impressed, rugulose, minutely rimulose areolate in older portions, ciliate, cilia about 2 mm. long, simple or once dichotomous, margins of some lobes capitate soraliate, soralia about 1 mm. in diameter, rarely subconfluent; underside rugulose, black, somewhat lighter toward the margins; upper cortex 40 μ thick, of fastigiate pseudoparenchyma, cells about 6 μ in diameter; algal layer 25 μ thick, cells 7 μ in diameter; medulla K–, C pink, KC–, 140 μ thick, of thickwalled, mostly longitudinal hyphae 6–7 μ in

diameter; lower cortex 50 μ thick, black, pseudoparenchymatous, cells 4 μ in diameter; rhizinae 60 μ in diameter, 3–5 mm. long, relatively few in the middle of the thallus, twice to thrice dichotomous.

Apothecia up to 9 mm. in diameter, rather rare, urceolate with margins incurved at first, becoming nearly plane, short stipitate; margin entire, exciple subscrobiculate, not sorediate; disc perforate, Hay's maroon or darker; amphithecial cortex 20–25 μ thick, fastigiate, hyphae 3.5 μ in diameter, lumina 1 μ, sparsely septate: algal layer 25 μ thick, of discrete colonies of *Trebouxia*, nearly continuous, occasionally pushing up between the cortical hyphae as if they might eventually form soredia on the exciple; medulla very lax; algal layer under the parathecium of scattered, discrete colonies up to 20 μ in diameter; parathecium 30 μ thick, of fastigiate, thickwalled pseudoparenchyma; hypothecium 10–13 μ thick, of gelified periclinal hyphae, scarcely staining; thecium 65 μ tall; paraphyses slender, conglutinate, septa not visible, simple or once dichotomous above the asci, terminal cells clavate, brownish; asci cylindric-clavate, thickwalled, protoplast long mamillate, tip nearly 10 μ thick when young, 50 $\times$ 15 μ, normally 8-spored; ascospores broadly ellipsoid, 13 $\times$ 10 μ with a thick epispore, up to 19 $\times$ 10 μ when some of the ascospores abort, monostichous at first, becoming subdistichous.

ETHIOPIA: Chokke Mts., 10° 40′ N., 37° 45′ E., corticole in *Erica arborea* zone below Talo, *R. G. Hiller L85*, C.B.E.E., at Kew.

CONGO: Kivu, route Kabare-Walungo, ramicole, *G. Troupin 2551 pars*, at Kew; Kahusi, 2700 m., *F. L. Hendrickx 4142, 4305* p. p. min. in E. African Herb.

KENYA: Kinango, 2250 m., growing over bryophytes on forest trees, *Allen Turner 6388*, ex Coryndon Mus., at Kew; Eldoret, 2220 m., on uliowa tree growing over roots of *Polystachya spatella, G. R. Williams 90A* p. p. min., at Kew; Guaso Nyiro, ramulicole, *G. M. Allen 1831* p. p. in Dodge Herb.

UGANDA: Kigezi, Mt. Mgahinga, 3380 m., on *Hypericum* trees with bryophytes, *A. S. Thomas 2431*; Mafuga, 2415 m., corticole, *I. R. Dale L50a*; Naiguru, 2255 m., *I. R. Dale L62* p. p. min.; Western Province, Ruwenzori, Toro District, ridge forest on Nyinbitaba, 2500 m., on orchid roots, *H. A. Omaston 1184*; Ruizi River, 1385 m., corticole, *T. Jarrett 402* p. p. min.; all at Kew; forest on Kanungu road, *A. Burnet L39b*, Makerere College Herb.

TANGANYIKA: Usambara, Amani, 1000 m., on main axes of *Usnea distensa* Stirton, *P. J. Greenway 998* p. p. min.; Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna*, *A. A. Bullock 1871* p. p. min., International Red Locust Control Service, both at Kew.

NYASALAND: Cholo Mt., 1400 m., saxicole in rain forest, *L. J. Brass 17697*, Vernay Nyasaland Exp. in Dodge Herb.

PARMELIA (AMPHIGYMNIA) NATALENSIS Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:515. 1926.

Type: S. Africa, Natal, Drackensberge, Van Reenen's Pass, Schwarzer Berg, 1700 m., on *Podocarpus*, *Brunnthaler*.

Thallus up to 20 cm. in diameter, pale glaucescent, greener when moist, center dirty argillaceous, appressed and radiately plicate, smooth, subnitid at the margins, subpunctate and rimulose areolate in the older portions, ciliate, cilia simple or dichotomous, about 2 mm. long; marginal lobes up to 20 mm. wide, rounded or more or less cuneiform, somewhat crenulate, sinuses acute, central lobes more deeply crenate, subimbricate and capitate soraliate, soralia subspheric, up to 1 mm. in diameter, with much smaller soralia developing rarely on some of the older central

lobes; underside black, minutely reticulate rugose, margins bister, rhizinae dense in spots on central lobes; upper cortex 9–13 (–22) μ thick, of fastigiate pseudoparenchyma, cells 5–6 μ in diameter, densely nubilated with brownish granules; algal layer about 30 μ thick, with algal cells penetrating deep in the medulla under diameter; medulla K–, C–, KC reddening, soon fading, 55 μ thick, of longitudinal hyphae moderately closely woven, less so just under the algal layer (tearing easily on sectioning), thickwalled, 2–4 μ in diameter; lower cortex 9–20 μ thick, very dark brown, of longitudinal thickwalled hyphae about 4 μ in diameter.

Apothecia rare on central portion of the thallus, 3–4.5 mm. in diameter, urceolate, margin incurved, sorediose, finally splitting radially, constricted below but not stipitate, disc fuscous, imperforate, virescent when moistened; amphithecial cortex 30–38 μ thick below, thinning to 20 μ on sides and 15 μ at the margin, fastigiate, hyphae 4–5 μ in diameter, thinner walled than in the thalline cortex; algal layer about 30 μ thicfi, with algal cells penetrating deep in the medulla under the soredia; algal layer under the parathecium 30 μ thick; parathecium 35 μ thick, of fastigiate pseudoparenchyma, cells 4–5 μ in diameter; hypothecium 15 μ thick, of conglutinate, periclinal hyphae; thecium 45–48 μ tall; paraphyses filiform, 2–2.5 μ in diameter, branched, tips clavate, up to 3.7 μ in diameter; asci broadly clavate, 44–50 μ long, 8-spored, tips thickened; ascospores ellipsoid, 11–17 $\times$ 8–10 μ, with a thin epispore.

Spermogonia immersed, subspherical, up to 150 μ in diameter, perifulcrum thicker and blackened about the ostiole; spermatiophores branched; spermatia bacilliform, 7–10.5 $\times$ 0.5–0.7 μ.

Our specimens are sterile except *I. R. Dale L43* p. p. from Uganda which has young apothecia, but the asci are too young to show ascospores. The description of apothecia and spermogonia is largely compiled from the original description. All our specimens agree in thalline characters except the fragmentary *Wilms 2705* which has the medulla KC–.

SOMALILAND: Libah Mele Mt., 1675 m., above Bjua Soldan, 10° 20′ N., 43° E., on twigs of *Grewia?* sp., *J. B. Gillett 4699* p. p. min., Abyssinia Somaliland Boundary Commission, at Kew.

KENYA: Guaso Nyiro, on twigs, *G. M. Allen 1831* p. p. min. in Dodge Herb.; Kericho, without collector, at Kew.

UGANDA: Ruizi River, 1385 m., tangled with *Usnea trichodeoides* Vainio, *T. Garrett 402* p. p. min.; Elgon, Madangi, 3550 m., on heath trees, *A. S. Thomas 607* p. p. min., ex herb. Dept. Agr. Uganda, at Kew; Kigezi, Kasatoro, Kabale River, 2255 m., on tree, *I. R. Dale L43* p. p. min., at Kew.

ANGOLA: Dundo near Rio Luachimo, 700 m., (Nordeste de Lunda, Circunscricão de Chitato, on branches of tall trees in gallery woods, *J. Gossweiler 13654a,* fragment, at Kew.

TRANSVAAL: Hout Bosch Berg, tropic of Capricorn, com. W. Nelson Aug. 1880, det. *P. latissima* v. *ciliata* Nyl. by Müller Argau, at Kew; Lydenburg District, near Lydenburg, *F. Wilms 2705,* at Kew.

CAPE OF GOOD HOPE: without locality or collector, herb. Hookerianum at Kew.

PARMELIA (AMPHIGYMNIA) **Sieberi** Dodge, sp. nov.

Parmelia perlata v. *praegrandis* Laurer, herb. nom.

Type: Mauritius, *Sieber,* Crypt Exot. 44, corticole, ex herb. Sbarbaro, at Farlow Herb.

Thallus 35–45 cm. diametro, centro cinnamoneo-alutaceus (1957), marginibus olivaceo-alutaceis, K flavus; lobis radiantibus, imbricatis, 120 × 45 mm., longitudinaliter rugosus, lateribus crispatis sorediosis, soralia sphaerica, ad 1 mm. diametro, dein confluentia, raris cum ciliis ad 2 mm. longitudine, apicibus crenatis, eciliatis, non sorediosis; infra niger, opacus, marginibus brunneis; rhizinis non visis; cortex superior 15 μ crassitudine, fastigiatus, cellulis 10 × 4–5 μ; stratum algarum 13–15 μ crassitudine, cellulis *Trebouxiae* 6–7 μ diametro; medulla K–, C–, KC–, 60 μ crassitudine, hyphis longitudinalibus 6–7 μ diametro, superne compactioribus, inferne laxioribus; cortex inferior 10 μ crassitudine, pseudoparenchymaticus, ex hyphis periclinalibus. Apothecia matura non visa.

Thallus 35–45 cm. in diameter, cinnamon buff in the center, shading to deep olive buff on the marginal lobes, K yellow, C bleaching to white; peripheral lobes radiating, imbricate, about 120 mm. long, up to 45 mm. wide, coarsely longitudinally rugose, margins of the sides of the lobes very crisped and sorediose, some soralia spherical up to 1 mm. in diameter, mostly confluent into a continuous thick marginal band, with an occasional marginal cilium up to 2 mm. long, ends of the lobes coarsely crenate, eciliate, smooth, not sorediose; surface smooth, not rimose in the older portions; underside black, opaque shading to a shining auburn margin 5 mm. wide or sometimes with a white band below the soralia on the sides of the lobes; rhizinae coarse, short; upper cortex 15 μ thick, fastigiate, cells 10 × 4–5 μ at the tips of dichotomous hyphae rising from the medulla, the interstices filled with algal cells forming a layer 13–15 μ thick, cells 6–7 μ in diameter; medulla K–, C–, KC–, 60 μ thick, of longitudinal hyphae 2–3 μ in diameter, moderately closely woven above, somewhat more loosely so next the lower cortex, heavily nubilated with grayish granules; lower cortex 10 μ thick, black, pseudoparenchymatous from periclinal hyphae, reaching up the sides of the lobes to the bottom of the algal layer. Only a few apothecial initials seen.

Another specimen of Sieber, Crypt. Exot. 44 is smaller, about 22 cm. in diameter, with shorter and narrower outer lobes, also from the Sbarbaro Herb. The Madagascar material is still deep olive buff almost to the center, probably from being a much more recent collection. The Robillard specimen from Mauritius consists of fragments of a much younger plant, perhaps not more than 20 cm. in diameter.

MAURITIUS: *Sieber*, Crypt. Exot. 44 sub *P. perlata* v. *praegrandis* Laur., herb. nom., type, ex herb. Sbarbaro, and sub *P. perlata* v. *grandis* Laur. in Tuckerman Herb.; *Robillard*, sub *P. cristifera* Tayl. det. Müller Argau; *Dr. Wight* sub *P. cristifera Taylor*, det. Taylor in Taylor Herb.; all at Farlow Herb.; Ponce, *Ayres*, at Kew.

MADAGASCAR: Province de Mandinitsara, native collector, sub *P. latissima* v. *sorediata* Nyl., ex herb. E. G. Paris and Hasse, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) HILDEBRANDTII Krmphbr., Linnaea **41**;61. 1877.

Parmelia Hildebrandtii v. *sorediosa* Müll. Arg., Flora **74**:376. 1891.

Type: Comoro Islands, Anjouan (Johanna) Island, 400 m., *J. M. Hildebrandt 1866c.*

Thallus up to 16 cm. in diameter, pale olive buff to olive buff, peripheral lobes subimbricate, 30 mm. long, 15 mm. wide, margins crisped, slightly crenate, eciliate,

central lobes very crisped, suberect, capitate soraliate becoming confluent; underside black with snuff brown margins, minutely reticulate rugulose; rhizinae very short, in dense groups in the center of the thallus; upper cortex 30 μ thick, fastigiate, not conglutinate, hyphae 6 μ in diameter, rather thinwalled, heavily nubilated with greenish brown granules; algal layer about 30 μ thick, of close, discrete colonies of *Trebouxia* in a nearly continuous layer; medulla K yellow then red, C–, KC yellow then red, 185 μ thick, of very thickwalled longitudinal hyphae, 6 μ in diameter, very heavily nubilated, with brownish granules, very closely woven above, somewhat looser below; lower cortex 30 μ thick, black, of interlaced strands of dark brown hyphae, 3 μ in diameter, with air spaces; rhizinae 55 μ in diameter.

Apothecia subpedicellate, crateriform, margin inflexed, crenulate, exciple nude or more often sorediate, disc concave, pale flesh color, rarely flattened; amphithecial cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 8 μ in diameter with moderately thick walls, disappearing over large areas being replaced by soredia; algal layer of discrete colonies, 30 μ in diameter; medulla very loosely woven, hyphae nubilated with yellow brown granules; algal layer under the parathecium 30–40 μ thick, continuous; parathecium 30 μ thick, of periclinal, thickwalled hyphae, 3 μ in diameter; hypothecium 8 μ thick, scarcely differentiated from the parathecium except the hyphal walls thinner and protoplasts more deeply staining; thecium 65 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches not moniliform, tips not thickened, reaching the surface of the brownish epithecial gel; asci clavate, about 40 $\times$ 10 μ, tips thickened; ascospores short ellipsoid, 11–15 $\times$ 10–12 μ, with a thick epispore.

Scott Elliott notes the native name "tainkwaka." "The powder with juice of citron and another plant said by natives an important medicine in primary syphilis."

TANGANYIKA: Kilimanjaro 1610 m., *H. H. Johnston* sub *P. perforata* v. *ulophylla* Mey & Fw., at Kew.

TRANSVAAL: Lydenburg District, near Lydenburg, on trees, *F. Wilms 2713*, at Kew, fertile.

NATAL: Umgoe Mts., *R. W. Plant* sub *P. perlata* v. *ciliata* f. *sorediifera*, det. Müller Argau, at Kew, left hand specimen.

RODRÍGUEZ ISLAND: *I. B. Balfour*, Venus Transit Exp., sterile, at Kew.

MADAGASCAR: *G. F. Scott-Elliott 2797*, det. *P. latissima* v. *sorediata* by Müller Argau, at Kew.

PARMELIA (AMPHIGYMNIA) **Allenii** Dodge, sp. nov.

Parmelia perlata v. *coniocarpa* Flotow, in Schimper, Iter Abyssinicum **2**: no. 1396. 1842, nom. nud.

Parmelia perforata f. *coniocarpa* Flotow, Linnaea **17**:17. 1843, nom. nud.

Type: Kenya, Lake Ngunga, 1775 m., on trees, *G. M. Allen 1837*, in Howe Herb. at Farlow Herb.

Thallus 13 cm. diametro, obscure olivaceo-alutaceus, marginibus pallidoribus, lobis peripheric is rotundatis, 10 mm. longitudine, 20 mm. latitudine, crenatis, ecili-atis, subcrispatis; lobis centralibus suberectis, crispatis, lobulis sparsis 1–2 mm. diametro, capitato-soraliatis, ad 1 mm. diametro, dein confluentibus; infra niger, reticulatim rugulosus, subnitidus, rhizinis 1 mm. longitudine, marginibus brunneis;

cortex superior 10–15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 3–4 μ diametro, granulis brunneis nubilatis; stratum algarum 30 μ crassitudine, coloniis caespitosis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K–, C superne rosea inferne negativa, KC–, 80 μ crassitudine, hyphis longitudinalibus 3 μ diametro, paucis obliquis verticalibusve; cortex inferior 30 μ crassitudine, fastigiatus, gelifactus, luminibus 7 $\times$ 1 μ.

Apothecia 5 mm. diametro, subsessilia, margine capitato-soraliato, excipulo minute scrobiculato, rugis subpulverulentis, disco brunneo; cortex amphithecialis 30 μ crassitudine; stratum algarum evanescens; medulla laxe contexta, hyphis periclinalibus 3 μ diametro; stratum algarum sub parathecio 30–50 μ crassitudine, continuum; parathecium 40 μ crassitudine, pseudoparaenchymaticum ex hyphis periclinalibus; hypothecium 10 μ crassitudine, hyphis periclinalibus; thecium 65 μ altitudine; paraphyses tenues, septatae, dichotomae super ascos, ramis submoniliformibus; asci ellipsoidea, 32 $\times$ 13–14 μ, leptodermei; ascosporae octonae, ellipsoideae, 13–16 $\times$ 7–8 μ, apisporio crasso.

Thallus 13 cm. in diameter, deep olive buff, shading to between olive buff and pale olive buff toward the margins, peripheral lobes rounded, 10 mm. long, 20 mm. wide, crenate, eciliate, somewhat crisped, central lobes suberect, very crisped, with occasional round lobules 1–2 mm. in diameter, margins capitate soraliate, soralia up to 1 mm. in diameter, mostly confluent into a band of coarse granular soredia, about 0.5 mm. wide; underside black, reticulate rugulose, subnitid, with a few stout rhizinae, 1 mm. long, marginal lobes warm brown, central lobes beneath the soredia abruptly warm buff to light buff; upper cortex 10–15 μ thick, of fastigiate thin-walled pseudoparenchyma, cells 3–4 μ in diameter, heavily nubilated with brown granules; algal layer of close discrete colonies of *Trebouxia*, 30 μ in diameter, cells 6–7 μ; medulla K–, C pink above, negative below, KC–, 80 μ thick, on lobules, 160 μ toward center of thallus, of moderately closely woven predominantly longitudinal hyphae about 3 μ in diameter, with a few oblique and vertical hyphae; lower cortex 30 μ thick, fastigiate, gelified, lumina 1 μ in diameter, 7 μ long; soredia about 30 μ in diameter.

Apothecia 5 mm. in diameter, nearly sessile, margin closely capitate soraliate, exciple minutely scrobiculate, ridges subpulverulent, disc burnt sienna or darker; amphithecial cortex 30 μ thick above, somewhat thicker below; algae disappearing under the cortex; medulla loosely woven, of mostly periclinal hyphae 3 μ in diameter; algal layer under the parathecium 30–50 μ thick, continuous above, less so below; parathecium 40 μ thick, of periclinal pseudoparenchyma; hypothecium 10 μ thick, of more slender and less closely septate hyphae; thecium 65 μ tall; paraphyses slender, septate, somewhat moniliform above, epithecial gel brownish about 15 μ thick; asci ellipsoid, 8-spored, 32 $\times$ 13–14 μ, rather thinwalled; ascospores ellipsoid 13–16 $\times$ 7–8 μ, with a moderately thick epispore.

In one apothecium, the thecium has been eaten away, and has regenerated as subspherical immarginate apothecia. Schimper, Iter Abyssinicum, II, no. 1396 is represented by two collections, at Kew, one fertile on which the above description of apothecia has been based, the other of two plants, the larger *P. Allenii* but sterile, the smaller a thallus of *P. hababiana* Gyelnik.

SOMALILAND: Ahlgebirge, 2000 m., on dead *Acacia* branches and twigs, *J. M. Hildebrandt 897* p. p. com. C. Rensch, det. *P. urceolata* v. *nuda* by Müller Argau at Farlow Herb., a duplicate at Kew sub *P. olivetorum* (Ach.) Nyl.

ETHIOPIA: Asella, Arussi, 2575 m., rainfall more than 50 inches, *H. F. Mooney 5145*; Haramat District, near Geraz, on bark of *Euphorbia Collquall, Schimper*, Iter Abyssinicum Sect. II, no. 1396 sub *P. perlata* v. *coniocarpa* Fw., nom. nud. (2 collections); all at Kew.

KENYA: Loita Plains, 60 miles southeast of Narok, 1610–2250 m., *Anita Grosvenor Curtis 743*, in Dodge Herb.; Lake Ngunga, 1775 m., *G. M. Allen 1837*, type, in Howe Herb. at Farlow Herb.; Chyulu Hills, *H. D. van Someren*, fragment in E. African Herb.; northeast side of Mt. Elgon, 2575 m., *A. Burnet L29, L30*, in Makerere College Herb.

UGANDA: Kigezi, Mafuga, on rocks, 2580 m., *I. R. Dale L52, L18* p. p. min.; Naiguru ridge, 2415 m., growing over hepatics on bark, *I. R. Dale L49*; Bunyoro, Busingoro, 1130 m., on *Poinsettia* bush, *I. R. Dale L51a;* all at Kew; Kiambu District, Limuru, 2130 m., *A. Burnet L6*, in Makerere College Herb.

CÔTE D'IVOIRE: Domaine soudano-guinéen, 20 km. north of Bouzke, *Guy Roberty 13530*, in Conservatoire Bot. Genève.

NORTHERN RHODESIA: Abercorn, *A. A. Bullock 1394*, International Red Locust Control Service, at Kew.

SOUTH AFRICA: Kentani District, 320 m., on *Acacia horrida, Alice Pegler 1231* p. p. min., at Kew.

PARMELIA (AMPHIGYMNIA) **cazengensis** Dodge, nom. nov.

Parmelia olivetorum v. *sorediosa* Vainio, Cat. Welwitsch African Pl. 2:399. 1901.

Type: Angola, Cazengo, Serra de Muxaula, *Welwitsch 112.*

Thallus up to 10 cm. in diameter, deep olive buff, peripheral lobes up to 20 mm. long and wide, margins smooth, crenate, somewhat crisped, central lobes smaller, more crisped with a narrow continuous band of powdery soredia, upper surface minutely reticulate rugulose in the center, smooth toward the margins, not reticulate rimulose, eciliate; underside black in the center shading to snuff brown at the margins, cinnamon buff to pinkish buff in a broad zone below the sorediiferous margins; rhizinae short, few, with disciform holdfasts; upper cortex 10–15 μ thick, fastigiate, gelified, hyphae 3 μ in diameter, lumina 1 μ, brownish in the outer 7–10 μ; algal layer 15 μ thick, of close, discrete colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K–, C pink throughout, KC–, 60–65 μ thick, of loosely woven, predominantly longitudinal hyphae with occasional vertical hyphae, 3μ in diameter, slightly nubilated with grayish granules next the algal layer; lower cortex 10 μ thick, gelified, fastigiate, lumina about 1.5 μ in diameter, lengths variable.

Thomas 3223 has the medulla KC pink soon fading; *Meliss 10* from St. Helena has the medulla KC violascent, while the *Dickson* specimen from St. Helena has the medulla K and KC yellowish.

CONGO: Mt. Kahusi, 2700 m., on twigs, *F. L. Hendrickx 4314* p. p. min. in E. African Herb.

UGANDA: Kigezi, Kasatoro forest, 1930–2575 m., corticole, *I. R. Dale L39*, p. p. min.; Karamoja, Timu forest, 2100 m. on twigs in hilltop forest, *A. S. Thomas 3224* p. p. min.; Kabale, 2000 m., on *Hibiscus rosa-sinensis* bush, *I. R. Dale L55* p. p. min.; Bugishu, Butandiga, 2415 m., on branches of trees, *A. S. Thomas 484* p. p. min. ex Herb. Dept. Agr. Uganda; all at Kew.

TANGANYIKA: Kilimanjaro, Bismarck Hill, 1000 m., corticole, *Grote*, ex B. L. Inst. Amani 8605, at Kew.

PORTUGUESE EAST AFRICA: Lourenço Marques, on *Citrus sinensis* branches, *J. P. Guimarais 26*, at Kew.

TRANSVAAL: near Lydenburg, corticole, *F. Wilms 2713* p. p. min. at Kew.

SOUTH AFRICA: Kentani District, 320 m., on *Acacia horrida, Alice Pegler 1231*, upper right, middle and lower left plants, at Kew.

?ST. HELENA: *J. C. Melliss 10* p. p. min.; *Dickson*; both at Kew.
ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler*, fragments at Kew.

PARMELIA (AMPHIGYMNIA) **Gossweileri** Dodge, sp. nov.

Type: Angola, Cabinda, Chiloango, *J. Gossweiler 8091*, com. 1919, at Kew.

Thallus 12 cm. diametro, olivaceo-alutaceus vel pallidior, lobis peripheric is 10 mm. longitudine, basi 10 mm. latitudine, superne ad 20 mm., rotundatis, minute rimolosis, marginibus crenatis, eciliatis; lobis centralibus lobulatis, lobulis 0.5 × 0.5 mm., apicibus capitato-soraliatis, soralia 1 mm. diametro, rare soraliis non stipitatis subconfluentibus; infra niger, marginibus castaneis, rhizinis rarissimis 1 mm. longitudine; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 6 μ diametro, leptodermei, granulis griseis nubilatis; stratum algarum 15 μ crassitudine, coloniis discretis et cellulis sparsis *Trebouxiae*, 5–6 μ diametro; medulla K–, C–, KC–, 100 μ crassitudine, hyphis longitudinalibus compacte intertextis, 5–6 μ diametro, granulis griseis nubilatis; cortex inferior 20 μ crassitudine, fastigiatus, brunneus, hyphis pachydermeis.

Apothecia rarissima, substipitata, 3 mm. diametro (immatura) marginibus 1 mm. crassitudine, crenatis, lobulatis, lobulis sphaeroides cum soraliis; disco urceolato, concavo, ochraceo-fulvo.

Thallus 12 cm. in diameter, probably larger, olive buff to between tilleul buff and pale olive buff, peripheral lobes 10 mm. long, 10 mm. wide at the base up to 20 mm. wide above, rounded, minutely rimulose, margins deeply crenate, eciliate, surface smooth; central lobes lobulate, lobules 0.5 mm. wide and tall, bearing a subspherical soralium 1 mm. in diameter, more rarely the soralia are not stipitate and subconfluent; underside black in the center, shading to chestnut at the margins, rhizinae very rare, stout, about 1 mm. long; underside of margins of central lobes cream color; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 6 μ in diameter, rather thinwalled, heavily nubilated with grayish granules; algal layer 15 μ thick, of discrete colonies and scattered cells of *Trebouxia*, 5–6 μ in diameter; medulla K–, C–, KC–, 100 μ thick, of compactly woven, longitudinal hyphae 5–6 μ in diameter, heavily nubilated with grayish granules, especially just under the algal layer and just above the lower cortex; lower cortex 20 μ thick, fastigiate, brownish, of very thickwalled hyphae.

Apothecia very rare, only two present and immature, substipitate, 3 mm. in diameter, margins 1 mm. thick, deeply crenate, lobulate, the lobules with spheroid soralia, disc urceolate becoming concave, ochraceous tawny.

Gossweiler 8057 has some confluent soralia with a few capitate soralia on the upper surface near the margins. The *Summerhayes* specimen is tentatively referred here. Studied within two months after it was collected, the upper surface is lichen green with occasional short cilia on a few lobes; the rhizinae are in small groups on the underside. *Guimares 11*, growing on a small branch, has a rugose center and is smaller, only 4 × 2 cm.

CÔTE D'IVOIRE: secteur para-litoral, *Guy Roberty 13764, 12689*, juvenile, in Conservatoire Bot. de Genève.

NORTHERN NIGERIA: Zoria District, 6 miles southeast of Kaciya, growing over mosses among orchid roots on tree trunk, *G. Summerhayes*, at Kew.

ANGOLA: Cabinda, Chiloango, *J. Gossweiler 6629, 8013, 8136*, all sterile, *8091*, fertile, type; *80336*, two thalli on right, sheet H 326–54, *8057;* all at Kew.

SUDAN: Onjiro, Issore, growing over hepatics, 1710 m., *T. T. Chipp 58*, at Kew.

TANGANYIKA: Mulinda forest southeast of Tukuyu (New Langenberg), 900 m., growing over roots of *Rangaenis muscicola, A. Stolz 2577B* p. p. min., at Kew.

NORTHERN RHODESIA: Abercorn, growing over roots of *Tridactyle teretifolia* Schltr., on *Brachystegia taxifolia, A. A. Bullock 2105* p. p. min., International Red Locust Control Service, at Kew.

LOURENÇO MARQUES: *J. P. Guimares 11*, at Kew.

PARMELIA (AMPHIGYMNIA) SUBCETRARIOIDES des Abb., Bull. Inst. Franç. Afrique Noire **13**:974. 1951.

Type: Guinée Française, Kankan, on mango, *des Abbayes*.

Thallus up to 10 cm. in diameter, deep olive buff or a little darker, lobes rounded, 8–10 mm. wide, rounded, very crisped and ascending in the center, appressed at the margins, entire or slightly lobulate, eciliate, central lobes capitate sorediate at first, soon confluent into a broad white band; underside black, shading to dark chestnut at the margins, more or less rugulose, rhizinae short, stout, scattered; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 5–6 μ in diameter, moderately thinwalled, very heavily nubilated with hyaline granules; algal layer 30 μ thick, continuous, cells 6–7 μ in diameter; medulla K–, C–, KC–, 135 μ thick, of predominantly longitudinal, closely woven hyphae 3 μ in diameter, with a few oblique or vertical hyphae, very heavily nubilated with brownish granules; lower cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 2.5 μ in diameter with very thick, dark brown walls.

CÔTE D'IVOIRE: Moyenne, triangle aride de Toumodi, Bouallé, south of Boka de Titiékro, *Guy Roberty 12673* p. p. min., at Conservatoire Bot. Genève.

PARMELIA (AMPHIGYMNIA) **olivetoroides** Dodge, sp. nov.

Type: Cape of Good Hope, without locality or collector, in Tuckerman Herb. sub *P. olivetorum*, at Farlow Herb.

Thallus ad 10 cm. diametro, olivaceo-alutaceus, lobis peripheric is 15 mm. longitudine latitudineque, rotundatis, marginibus eciliatis, subcrenatis, non crispatis; lobis centralibus minoribus adscendentibus, crispatis, marginibus confluenter sorediosis pulverulentis; inferne reticulatim rugulosus, centro niger, marginibus brunneis; cortex superior 7 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis 3.5 μ diametro, granulis brunneis nubilatis; stratum algarum 20–25 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K–, C–, KC–, 50–55 μ crassitudine, hyphis longitudinalibus laxissime contextis, paucis cum hyphis verticalibus, non nubilatis; cortex inferior 7 μ crassitudine, pseudoparenchymaticus ex hyphis longitudinalibus. Apothecia non visa.

Thallus up to 10 cm. in diameter, deep olive buff, peripheral lobes flat, 15 mm. long and wide, round, margins eciliate, slightly crenate, central lobes smaller, ascending, slightly crenate, crisped, margins completely powdery sorediose in a band 0.2–0.3 mm. wide; underside reticulate rugulose, black in the center shading to buckthorn brown on the margins or a broad band of buff yellow on lobes with

sorediate margins; rhizinae not seen as central portions are glued to the herbarium sheet; upper cortex 7 μ thick, of fastigiate pseudoparenchyma, cells thinwalled, 3.5 μ in diameter, heavily nubilated with brownish granules; algal layer 20–25 μ thick, subcontinuous, of discrete colonies of *Trebouxia*, cells 6–7 μ in diameter; with relatively large air spaces between algal cells; medulla K–, C–, KC–, 50–55 μ thick, of very loosely woven, longitudinal hyphae, with some vertical hyphae uniting the two cortices, not nubilated; lower cortex 7 μ thick, apparently of pseudoparenchyma from two layers of longitudinal hyphae in a pale brownish gel. Apothecia not seen.

CAPE OF GOOD HOPE: without locality or collector, in Tuckerman Herb. sub *P. olivetorum*, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) GLAUCOCARPOIDES Zahlbr., Cat. Lich. Univ. 6:167. 1929.

Parmelia glaucocarpa Müll. Arg., Flora 67:615. 1884, non Ach.

Type: Madagascar, Nossi Be, ramulicole, *J. M. Hildebrandt*, Nov. 1880, portion of type collection ex herb. Sbarbaro, at Farlow Herb.

Thallus investing twigs, 9 cm. long, 4 cm. wide, between cream buff and olive buff (1957), lobes rounded, 10 mm. long, 15 mm. wide, margins coarsely dentate to lobulate, lobules up to 5 mm. wide and long, margins revolute, appearing corniculate, sometimes deeply crenate, almost digitate, surface smooth to slightly rugose or coarsely undulate and somewhat crisped, all margins ciliate, cilia up to 2 mm. long; under side black in the center, rarely almost to the margin, usually abruptly cinnamon to Sayal brown, reticulate rugulose; rhizinae dense in the center, about 10 mm. long, tips branched where in contact with the twig; upper cortex 10–12 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells 4–5 μ in diameter, slightly nubilated with hyaline granules; algal layer of widely spaced colonies of *Trebouxia*, 15 μ in diameter, cells 7 μ in diameter; medulla K–, C–, KC–, 30 μ thick, upper third of closely woven longitudinal hyphae, the rest of more loosely woven, mostly oblique hyphae 3–4 μ in diameter, not nubilated; lower cortex 5–6 μ thick, a single layer of very thickwalled longitudinal hyphae, protoplasts spherical, 1 μ in diameter.

Apothecia 5–7 mm. in diameter, stipitate, stipe hollow, about 3 mm. tall, 2 mm. in diameter, smooth, becoming somewhat longitudinally rugose; margin entire to minutely crenulate, exciple smooth, minutely white punctate and subreticulate but not pseudocyphellate, sometimes rugose near the stipe; disc deeply concave becoming flattened, somewhat pruinose, finally nude and buckthorn brown, perforate, hole 1 (–2) mm. in diameter, sometimes splitting to the margin of the perforation; amphithecial cortex 50–85 μ thick, fastigiate, gelified, nubilated in the outer 15 μ with brownish granules; algal colonies 15–30 μ in diameter, widely spaced, some pushing up into the amphithecial cortex in columns 50 $\times$ 15 μ, cells 6–7 μ in diameter; medulla of periclinal, loosely woven hyphae; algal layer under the parathecium of discrete colonies 30 μ in diameter; parathecium 15 μ thick, fastigiate, gelified; hypothecium 20 μ thick, of closely woven slender hyphae; thecium 85–90 μ tall; paraphyses slender, septate, simple or dichotomous above the

asci, branches moniliform above, terminal cells subspherical, 5 μ in diameter, thick-walled, apparently cut off to form the pruina, epithecial gel brownish to a depth of 10 μ, nubilated with brownish granules; asci broadly ellipsoidal, 45 $\times$ 30 μ, wall 3 μ thick, tip not thicker, 8-spored; ascospores ellipsoidal, 23–28 $\times$ 12–14 μ, epispore about 2 μ thick.

Hildebrandt, July 1875 has the lobes more sparsely ciliate, many nude, lobules up to 8 mm. long, digitately or coralloid branched margins revolute and deeply canaliculate below.

MADAGASCAR: Nossi Be, ramulicole, *J. M. Hildebrandt,* Nov. 1880, type collection; Berari, ramulicole, *J. M. Hildebrandt,* July 1875; Imerina, Andrangolaoka, 1200 m., saxicole, *J. M. Hildebrandt 2172a,* fragments growing with *Usnea pulvinata* Fr.; ramulicole, *J. M. Hildebrandt,* July 1875 sub *P. latissima* v. *corniculata* Krmplhbr.; all ex herb. Sbarbaro, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) **nigeriensis** Dodge, sp. nov.

Type: Nigeria, Plateau Province, Panshin, Mongu Forest Reserve, north of road between Mongu and Gindiri, near mile 4 in open woodland savannah, corticole, *D. E. S. Keay & R. W. J. King 37096,* ex Forest Herb. Ibadan, at Kew.

Thallus 8 $\times$ 5 cm., griseo-olivaceus, lobis peripheris rotundatis, 10 mm. longitudine latitudineque, marginibus crispatis, dense cilatis, cilia 1.5–2 mm. longitudine, lobulis ad 1 mm. longitudine, 0.2 mm. latitudine, lobis centralibus minoribus lobulatisque, lobulis variabilibus; inferne niger, rhizinosis, lobis peripheris alutaceis, reticulatim rugulosis; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis 5–6 μ diametro, protoplastis sphaericis, 1 μ diametro, granulis brunneis nubilatis; stratum algarum 18 μ crassitudine, coloniis discretis, *Trebouxiae,* cellulis 5 μ diametro; medulla K–, C–, KC–, 80 μ crassitudine, hyphis pachydermeis longitudinalibus, dense contextis; cortex inferior nigro-brunneus, 15 μ crassitudine, hyphis longitudinalibus, cellulis isodiametricis, 6 μ diametro.

Apothecia 14–15 mm. diametro, stipitata, stipitibus 2 mm. diametro, 5 mm. altitudine, laevibus aut longitudinaliter subrugulosis, margine dentato lobulatoque, ciliato; excipulo reticulatim ruguloso vel scrobiculato, disco perforato, concavo applanatove, brunneo; cortex amphithecialis 80 μ crassitudine, fastigiatus, hyphis 6 μ diametro, septatis luminibus ca. 1 μ diametro, parte extera granulis brunneis nubilata; stratum algarum 45–55 μ crassitudine, continuum; medulla subarachnoidea; stratum algarum sub parathecio 30 μ crassitudine, subcontinuum; parathecium 30 μ crassitudine, hyphis periclinalibus, cellulis isodiametricis; hypothecium hyphis periclinalibus ab parathecio non bene distinctum; thecium 80 μ altitudine; paraphyses tenues, septatae, multoties dichotomae super ascos, superne nubilatae; asci clavati, 65 $\times$ 15 μ, apicibus juventute incrassatae; ascosporae quaternae octonaeve, ellipsoideae, 16–19 $\times$ 11 μ episporio crasso.

Thallus 8 $\times$ 5 cm., grayish olive, peripheral lobes rounded, 10 mm. long and wide, margins crisped, closely ciliate, cilia 1.5–2 mm. long, occasionally lobulate, lobules up to 1 mm. long, 0.2 mm. wide, surface smooth, opaque; central lobes somewhat smaller, more closely lobulate, lobules variable in size and shape; underside black in the center, shading to warm buff or cinnamon buff on the margins of the peripheral lobes, reticulate rugulose, nude, center with rather dense long

rhizinae; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, hyphae 5–6 μ in diameter, protoplasts spherical about 1 μ in diameter, nubilated with brownish granules; algal layer 18 μ thick of discrete colonies of *Trebouxia* in a nearly continuous layer, a few cells deeper in the medulla, cells 5 μ in diameter; medulla K–, C–, KC–, 80 μ thick, of very closely woven longitudinal thickwalled hyphae 6 μ in diameter, not nubilated; lower cortex dark brown, 15 μ thick, of pseudoparenchyma from longitudinal hyphae, cells 6 μ in diameter.

Apothecia abundant, 14–15 mm. in diameter, stipes 5 mm. tall, 2 mm. in diameter, smooth or slightly longitudinal rugulose; margin dentate to closely lobulate and ciliate, exciple reticulate rugulose to shallowly scrobiculate; disc perforate, concave to flattened, argus brown; amphithecial cortex 80 μ thick, fastigiate, hyphae 6 μ in diameter, lumina about 1 μ, septate but not closely so, outer 20 μ heavily nubilated with brownish granules; algal layer 40–50 μ thick, nearly continuous, in places columns of algal cells pushing up between the cortical hyphae for 50 μ; medulla loosely woven below to almost arachnoid above; algal layer under the parathecium 30 μ thick, of discrete colonies; parathecium 30 μ thick, pseudoparenchymatous from periclinal hyphae; hypothecium scarcely differentiated from the parathecium but hyphae with thinner walls; thecium 80 μ tall; paraphyses slender, septate, several times dichotomous above the asci, heavily nubilated in the upper 10 μ; asci clavate, 65 $\times$ 15 μ, tips thickened when young, 4–8-spored; ascospores 16–19 $\times$ 11 μ, ellipsoid, with thick epispore.

Holland 59 is doubtfully referred here. It is sterile, the thallus is larger and paler, the central lobules somewhat smaller. Perhaps it is an ecologic variant coming from a much lower elevation.

NIGERIA: Plateau Province, Pankshin, Mongu Forest Reserve, north of road between Mongu and Gindiri, near mile 4 in open woodland savannah, corticole, *D. E. S. Keay & R. W. J. King 37096* ex Forest Herb. Ibadan; Old Calabar, Consulate Hill, corticole, *J. H. Holland 59*; both at Kew.

PARMELIA (AMPHIGYMNIA) EURYCARPA Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:530. 1926.

Type: Tanganyika, East Usambara, Amani, 800 m., corticole, *Brunnthaler.*

Thallus up to 12 cm. in diameter, between vinaceous buff and olive buff (1957), peripheral lobes 25 mm. long, 20 mm. wide, rounded, narrowly black margined, slightly crenate, cilia up to 4 mm. long, central lobes more deeply crenate and lobulate, lobules 1–3 mm. long, 0.5–1 mm. wide, tips truncate, rarely retuse, occasionally di- or trichotomous, 1–2 ciliate; surface slightly impressed, slightly rimulose in the older portions; underside black, reticulate rugulose, subnitid, margins auburn or darker, smooth, shining; rhizinae few in small groups, up to 2 mm. long, resembling the cilia unless making contact with the substrate, then shorter, stouter, forming a disciform holdfast 0.5 mm. in diameter; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, hyphae moniliform, cells 6–7 μ in diameter, lumina 2 μ, heavily nubilated with brownish granules; algal layer 15 μ thick, of widely spaced colonies of *Trebouxia,* cells 6–7 μ in diameter, nubilated with brownish granules; medulla K yellow, unevenly rufescent, C–, KC–, 65 μ thick, of moderately closely woven longitudinal hyphae, nubilated with brownish

granules, with occasional air spaces under the algal layer, up to half the thickness of the medulla, crossed by some vertical hyphae 3 μ in diameter, only slightly nubilated; lower cortex black, 12–13 μ thick, of longitudinal thickwalled hyphae, very dark brown, cells 4–5 μ in diameter.

Apothecia cupuliform, up to 20 mm. in diameter, stipe 2 mm. tall, 4 mm. in diameter, longitudinally rugose; margin incurved, smooth, exciple minutely scrobiculate, disc imperforate, cinnamon brown; amphithecial cortex 20–25 μ thick, gelified, fastigiate, of rather thinwalled pseudoparenchyma, interrupted by air passages to the algal layer and occasionally algal cells pushing up to the surface; algal layer 40 μ thick, continuous, cells closely packed above, more scattered next the medulla; algal layer under the parathecium 30 μ thick, of close colonies, heavily nubilated with brownish granules above; parathecium 15–20 μ thick, of fastigiate pseudoparenchyma; hypothecium 15 μ thick, of slender periclinal hyphae, the lower half very closely woven, the upper half loosely woven; thecium 55 μ tall; paraphyses slender, septate, tips not thickened, ending about 8 μ below the surface of the brownish epithecial gel; asci cylindric clavate, 65 $\times$ 18 μ, wall 3–4 μ thick, tip thicker, 8-spored; ascospores monostichous at first becoming distichous, ellipsoidal, 19–29 $\times$ 11.5–18 μ.

Bullock 1871 pars is fertile but the ascospores are apparently not quite mature, reaching only the minimum dimensions given in the original description. The Kenya specimen is sterile, the cilia are somewhat longer and the medulla is K slightly yellowish, not unevenly orange rufescent. Since is was growing on humus among rocks in the forest, the near absence of the K reaction may be due to shade.

KENYA: Wandangi Hill, on decaying vegetable debris among rocks in forest, *Goanna* (native collector) ex herb. E. African Agr. Res. Sta. 8974, in E. African Herb.

TANGANYIKA: Ifipa, Malonje, 2575 m., growing over roots of *Acrangis* on *Ochna* sp., *A. A. Bullock 1871* pars, International Red Locust Control Service, at Kew.

NYASALAND: Kota-Kota District, Mt. Nchisi, 1400 m., on dead branch of *Brachystegia, L. J. Brass 17622, 16918*, immature, both in Dodge Herb.

PARMELIA (AMPHIGYMNIA) **amboimensis** Dodge, sp. nov.

Type: Angola, Cuanza Sul, Amboim, Capir near Carloaongo-Cuvo River, 1000 m., corticole, *J. Gossweiler 9993*, at Kew.

Thallus 10 cm. diametro, dilute olivaceo-alutaceus, lobis irregulariter dichotomis, 5 mm. latitudine, marginibus revolutis, ciliatis, ciliis tenuibus, 1–3 mm. longitudine, lobulis ultimis variabilibus, aliis 1 mm. latitudine, apicibus rotundatis, truncatis retusisve, alteris magis rotundatis, 5 mm. diametro, lobulis brevibus truncatis, sinibus rotundatis; infra niger, centro reticulatim rugosus, marginibus laevibus, rhizinis 2–3 mm. longitudine, simplicibus furcatisve; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 4–5 μ diametro, granulis brunneis nubilatis; stratum algarum coloniis discretis *Trebouxiae*, 15 μ diametro, cellulis sparsis 6μ diametro; medulla K–, C roseo, KC rubra, 30 μ crassitudine, hyphis longitudinalibus 3 μ diametro; cortex inferior niger, 7 μ crassitudine, pseudoparenchymaticus ex hyphis longitudinalibus.

Apothecia ad 10 mm. diametro, urceolata, stipite 4–5 mm. altitudine, 4 mm. diametro, laevis, longitudinaliter rugosus sub excipulo; margine integro, inflexo,

excipulo laevi dein impresso-punctato aut minute scrobiculato; disco rufo-brunneo, imperforato; cortex amphithecialis 25 μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 30 μ crassitudine, coloniis discretis et cellulis singulis sparsis; stratum algarum sub parathecio 25 μ crassitudine, subcontinuum, coloniis discretis; parathecium 13–15 μ crassitudine, gelifactum, pseudoparenchymatice fastigiatum; hypothecium 10 μ crassitudine, hyphis tenuibus compacte intertextis; thecium 50 μ altitudine; paraphyses tenues, septatae, super ascos dichotomae, apicibus non incrassatis; asci clavati, 44 $\times$ 15 μ, pachydermei, apicibus incrassatis, ascosporae octonae, late ellipsoideae, 10–13 $\times$ 7 μ, episporio crasso.

Thallus 10 cm. in diameter, pale olive buff, lobes irregularly dichotomous, about 5 mm. wide below, margins revolute, ciliate, cilia slender, 1–3 mm. long, ultimate lobules variable, 1 mm. wide, tips rounded, truncate or retuse, others more rounded, 5 mm. in diameter with short truncate lobules and rounded sinuses; underside black, reticulate rugose, smooth near the margins; rhizinae single or in small groups in the center of the lobes, simple or forked, 2–3 mm. long, resembling cilia, those in the center of the thallus short, stout, forming disciform holdfasts; upper cortex 20 μ thick, of fastigiate thinwalled pseudoparenchyma, cells 4–5 μ in diameter, heavily nubilated with brownish granules in the outer 15 μ; algal layer of discrete colonies of *Trebouxia*, 15 μ in diameter and scattered cells 6 μ in diameter; medulla K–, C pink, KC a deeper pink, 30 μ thick of moderately closely woven longitudinal hyphae 3 μ in diameter, sending vertical branches up between the algal cells and colonies to the upper cortex; lower cortex gelified, black, 7 μ thick, pseudoparenchymatous from longitudinal hyphae.

Apothecia 10 (–15) mm. in diameter, deeply urceolate at first, stipe 4–5 mm. tall, 4 mm. in diameter, smooth, slightly longitudinally rugose at the base of the exciple; margin entire, inrolled at first, exciple smooth, becoming impressed punctate to minutely scrobiculate; disc auburn or darker, long imperforate, finally perforate; amphithecial cortex 25 μ thick, of fastigiate thinwalled pseudoparenchyma; algal layer 30 μ thick, of scattered colonies and single cells; algal layer under the parathecium 25 μ thick, of discrete colonies forming a nearly continuous layer; parathecium 13–15 μ thick, of fastigiate gelified pseudoparenchyma; hypothecium 10 μ thick, of slender, very closely woven hyphae; thecium 50 μ tall; paraphyses slender, septate, dichotomous above the asci, tips not thickened, ending about 3 μ below the surface of the dark brown epithecial gel; asci clavate, 45 $\times$ 15 μ, wall 3 μ thick, tips 6 μ; ascospores broadly ellipsoidal, 10–13 $\times$ 7 μ, with a moderately thick epispore.

CAMEROUN: between Jaunde and Dengdeng, south of the Sanaga River near the confluence of Lom (Sanaga) and Djerem rivers, about 165 km. northeast of Jaunde, *J. Milbraed III, 8403*, at Kew.

ANGOLA: Cuanza Sul, Amboim, Capir near the Carloaongo-Cuvo River, 1000 m., corticole, *J. Gossweiler 9907, 9993*, type; Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler* com. 1910; Cazengo, Granja Sao Luiz, on dead twigs in dense forest, *H. H. W. Pearson 2327* p. p. min., Percy Sladen Mem. Exp. to South West Africa; all at Kew.

UGANDA: Mt. Elgon, 1290 m., corticole, *W. Small 217* p. p. min.; Kigezi, Mafuga, 2415 m., corticole, *I. R. Dale L50* p. p. min.; both at Kew.

PARMELIA (AMPHIGYMNIA) PROCERA Steiner & Zahlbr., Bot. Jahrb. [Engler] 60: 537. 1926.

Type: Tanganyika, East Usambara, Amani, 800 m., *Brunnthaler, Schroeder 181.*

Thallus 10–15 cm. in diameter, tea green, peripheral lobes 15 mm. wide, rounded, margins very crisped, shallowly crenate, ciliate, cilia slender, 2–3 mm. long, central lobes with lobulate margins, lobules 1–1.5 (–2) mm. long, sublinear, margins revolute, tips somewhat crisped and crenulate, ascending, sparingly ciliate; upper surface smooth, subnitid, not rimulose; underside black in the center, slightly rugulose, opaque, margins of peripheral lobes russet to tawny, smooth and shining; rhizinae few, stout, short, tips branching to form a holdfast when in contact with the substrate; upper cortex 12 μ thick, of fastigiate pseudoparenchyma, cells 3 μ in diameter, lumina 1 μ, heavily nubilated with subhyaline granules; algal layer 15–20 μ thick, continuous, cells 6–7 μ in diameter, tending to be arranged in vertical rows; medulla K black, C–, KC–, (K–, KC reddening in original description), 65 μ thick, of predominantly longitudinal hyphae 3 μ in diameter with many vartical hyphae connecting the cortices, moderately closely woven, somewhat looser with more vertical hyphae just under the algal layer; lower cortex 12–15 μ thick, of fastigiate gelified pseudoparenchyma, lumina about 1 μ in diameter, deep brown in section, not nubilated.

Apothecia urceolate at first then cupulate, finally plane and floriform by splitting into lobes and the margins healing, 20–30 mm. in diameter, stipes 7 mm. tall, 4 mm. in diameter; margin crenulate, inrolled, exciple smooth to faintly and minutely impressed in older apothecia, subnitid; disc russet darkening; amphithecial cortex 30–35 μ thick, of fastigiate gelified pseudoparenchyma heavily nubilated with brownish granules; algal layer 30 μ thick, of close discrete colonies of *Trebouxia*, cells 6–7 μ in diameter; algal layer under the parathecium 30 μ thick, continuous; parathecium 15 μ thick, of gelified periclinal pseudoparenchyma, protoplasts 3–4 $\times$ 2 μ; hypothecium 15 μ thick, of slender, closely woven periclinal hyphae; thecium 40 μ tall; paraphyses slender, septate, dichotomous above the asci, tips slightly clavate reaching the surface of the brownish epithecial gel; asci ellopsoid, 8-spored, 45 $\times$ 16 μ, wall 3 μ thick, tip slightly thicker; ascospores elongate ellipsoid, 13–17 $\times$ 5.5–7 μ, showing a curious bipolar staining when still in the ascus, and falsely 2-celled when free.

Spermogonia 120–140 μ in diameter; wall dark brown; spermatia 4.5–7 $\times$ 0.7–0.8 μ, fide Steiner & Zahlbr., l.c.

TANGANYIKA: East Usambara, Amani, 1000 m., on trees in rain forest, *P. J. Greenway 1001*, in East African Herb.

CONGO: km. 30, route Kahusi, *F. L. Hendrickx 4330*, young and sterile, in E. African Herb.

PARMELIA (AMPHIGYMNIA) **aldabrensis** Dodge, sp. nov.

Type: Aldabra Islands, on tamarind, *Walter Fox 220*, com. P. R. Dupont, at Kew.

Thallus 14 cm. diametro, olivaceo-alutaceus, lobis peripheric is radiantibus, imbricatis, 40 mm. longitudine, 10 mm. latitudine, lateribus crenatis, marginibus

lobulatis, lobulis ca. 1 mm. longitudine, 0.5–1 mm. latitudine, apicibus rotundatis, crenulatisque; lobulis centralibus magis rotundatis, substipitatisque; superficie laevi dein impresso-punctato, centro minute subrugosa; inferne niger, marginibus brunneis nudis; rhizinae 1 mm. longitudine; cortex superior 10 μ crassitudine, pseudoparenchymatice fastigiatus, granulis brunneis dense nubilatus; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae,* cellulis 5–6 μ diametro; medulla K flavescens, C–, KC–, 65 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, dense contextis, granulis griseis nubilatis; cortex inferior 5–6 μ crassitudine, pseudoparenchymaticus, cellulis 2.5–3 μ diametro.

Apothecia urceolata, ad 3 mm. diametro, stipite 1 mm. diametro, 1 mm. altitudine, margine integro, excipulo minute alboreticulato, subruguloso; disco electrino-brunneo, perforato; cortex amphithecialis 60 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis pachydermeis, strato amorpho 5 μ crassitudine tectus; stratum algarum 30–40 μ crassitudine, subcontinuum, cellulis 6–7 μ diametro; medulla granulis griseis dense nubilata; stratum algarum sub parathecio 30 μ crassitudine, coloniis discretis; parathecium 25 μ crassitudine, hyphis septatis periclinalibus conglutinatis, luminibus 2.5 μ diametro; hypothecium non bene distinctum; thecium 60 μ altitudine; paraphyses tenues, dichotomae, ramis ultimis submoniliformibus apicibus non incrassatis; asci clavati, 40 $\times$ 16 μ, apicibus juventute incrassatis; ascosporae octonae, ellipsoideae, 13–16 $\times$ 5–6 μ episporio tenui.

Thallus 14 cm. in diameter, between deep olive buff and olive buff, peripheral lobes radial, imbricate, 40 mm. long, 10 mm. wide, deeply crenate on sides, margins lobulate, lobules 0.5–1 mm. wide, 1 mm. long, cilia 1–1.5 (–2) mm. long, tips of lobes more rounded, crenulate, central lobules about 1 mm. in diameter, more rounded and substipitate; surface smooth becoming impressed punctate and minutely subrugose near the center; underside black with Brussels brown margins, rhizinae in scattered groups, about 1 mm. long, tips acute unless making contact with the substrate, where they form holdfasts about 0.3 mm. in diameter; upper cortex 10 μ thick, of fastigiate pseudoparenchyma, very heavily nubilated with brownish granules; algal layer 15 μ thick, of discrete colonies of Trebouxia in a nearly continuous layer, cells 5–6 μ in diameter; medulla K yellow, C–, KC–, 65 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter, heavily nubilated with grayish granules; lower cortex 5–6 μ thick, pseudoparenchymatous, about 2 cells thick.

Apothecia up to 5 mm. in diameter, stipe 1 mm. tall, 1 mm. in diameter, margin smooth, exciple minutely white reticulate, slightly rugulose, disc concave, amber brown, finally perforate; amphithecial cortex 60 μ thick, of fastigiate pseudoparenchyma, very thickwalled, outer 5 μ amorphous; algal layer 30–40 μ thick, nearly continuous, cells 6–7 μ in diameter; medulla dense, heavily nubilated with grayish granules; algal layer under the parathecium about 30 μ thick, less continuous than under the amphithecial cortex; parathecium 25 μ thick, of septate, conglutinate periclinal hyphae, lumina 2.5 μ in diameter; hypothecium not well differentiated; thecium 65 μ tall; paraphyses slender, dichotomous about the middle and once or twice above, the ultimate branches submoniliform, tips not thickened nearly reaching the surface of the pale brownish epithecial gel; asci clavate, 8-

spored, 40 × 16 μ, tips thickened when young, protoplast short mamillate; ascospores ellipsoid, 13–16 × 5–6 μ, with a thin epispore.

ALDABRA ISLANDS: on tamarind, *Walter Fox 220,* com. P. R. Dupont, type, at Kew.

PARMELIA (AMPHIGYMNIA) **subbullata** (Steiner & Zahlbr.) Dodge, comb. nov.

Parmelia pedicellata v. *subbullata* Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:536. 1926.

Type: Tanganyika, Bukoba, near Lake Victoria Nyanza, *Schroeder 323*; Kenya, Kikuju near Nairobi, *Horn*; neither designated as type.

Thallus up to 10 cm. in diameter, from buffy brown to avellaneous and from deep olive buff to olive buff, peripheral lobes 30 mm. long, 7–10 mm. wide below expanding to 30 mm. above, irregularly divided by deep sinuses into 3–5 rounded lobes about 10 mm. in diameter, margins smooth or shallowly crenulate, coarsely crisped, cilia about 0.5 mm. long, occasionally lobulate (as a result of regeneration following injury or insect damage), lobules rounded conchiform, about 1 mm. in diameter; upper surface closely rugulose in the center, subbullate, marginal lobes smooth to slightly impressed; underside black in the center, opaque, reticulate rugulose shading to warm sepia to Verona brown at the smooth margins; rhizinae in small groups, short, stout, ending in deeply branched tips, forming more or less confluent holdfasts on the surface of the bark; upper cortex about 12 μ thick, of fastigiate pseudoparenchyma, cells 4 μ in diameter, the upper 2 cells heavily nubilated with brownish granules; algal layer up to 30 μ thick, of discrete colonies of *Trebouxia,* about 15 μ in diameter with scattered cells below, cells mostly 5–7 μ in diameter; medulla K–, C faint pink, KC–, 65 μ thick, of loosely woven strands of longitudinal hyphae 3 μ in diameter with some vertical hyphae and moderate air spaces; lower cortex about 15 μ thick thinning to 7–8 μ at the margin, of fastigiate pseudoparenchyma, cells somewhat irregularly arranged, lumina about 1 μ in diameter.

Apothecia in the center of the thallus, 10 (–15) mm. in diameter, urceolate with inrolled entire margin at first, long cupulate, finally splitting and irregularly flattened, short stipitate, margin slightly crenate; exciple minutely reticulate rugose and subscrobiculate, not cracking along the ridges, disc widely perforate, auburn, regenerating the amphithecial cortex, where the thecium is eaten away by insects; amphithecial cortex 50 μ thick, of fastigiate pseudoparenchyma, hyphae 3 μ in diameter, protoplasts 2 μ, nubilated in the outer half; algal layer 30–50 μ thick, of close, discrete colonies in a nearly continuous layer, (upper surface crenate in section); medulla loosely woven; algal layer under the parathecium 30 μ thick, closely packed above, more loosely so below in a continuous layer (upper surface crenate in section); parathecium about 15 μ thick between the algal colonies, only 7–8 μ above them, hyaline, fastigiate, protoplasts spherical, 2.5–3 μ in diameter, becoming periclinal next the hypothecium; hypothecium 30 μ thick, of moderately closely woven slender periclinal hyphae, deeply staining; thecium 75 μ tall; paraphyses slender, septate, often dichotomous above the asci, tips clavate, ending in the brownish epithecial gel, sometimes reaching the surface; asci, clavate, thin-walled, 50 ×15 μ, tip 3 μ thick, 8-spored; ascospores ellipsoidal, 10–15 × 7–9 μ.

Since my sections are taken from the margin of the lobe and perpendicular to

it in all cases, the dimensions are smaller than those reported in the original description, but they agree anatomically. The medullar reaction with C is less intense than that called for in the original description.

KENYA: Northern Frontier Province, Moyale, 3° 32′ N., 39° 03′ E., 1255 m., on old trees, *J. B. Gillett 12918*, very immature, at Kew.

UGANDA: E. Tropical Africa between 2° and 7° S., *James Hannington*, immature; Bunyiro, Busingoro, 1130 m., on bark of old *Jacaranda* tree, *I. R. Dale L54, L68*; all at Kew.

TANGANYIKA: Nkunde-Chapota, 2250 m., growing over roots of *Diaphananthe pulchella* Summerh. on branch of *Acacia*, 20 ft. from ground, in dense shade, *A. A. Bullock 1962 pars*, International Red Locust Control Service, at Kew.

NYASALAND: Nyika Plateau, 2340 m., on tree branches, *L. J. Brass 17214*, Vernay Nyasaland Exp., sterile, juvenile, in Dodge Herb.

PARMELIA (AMPHIGYMNIA) ABESSINICA Nyl. in Krmph., Linnaea 41:140. 1877.

Parmelia abyssinica Nyl., Flora 68:608. 1885.

Type: Ethiopia, Maeshalit, *J. M. Hildebrandt*; Habab, 1610 m., *J. M. Hildebrandt 314*!

Thallus 4–5 cm. in diameter, K yellow, citrine drab to cream buff and chamois in older portions near apothecia, lobes rounded, 10 mm. or more wide, margins ascending, flexuous and coarsely crisped, with scattered black cilia, crenulate to fimbricate lobulate from splitting in the angles, surface rugulose, smooth toward the margins; underside black, minutely reticulate rugose with a few coarse rhizinae near the center of the lobes, 2–3 mm. long, margins sometimes black, often cream buff or lighter; upper cortex 10 μ thick, of fastigiate pseudoparenchyma, highly gelified; algal layer up to 30 μ thick, of discrete but nearly continuous colonies of *Trebouxia*, cells 6 μ in diameter; medulla K–, C–, KC–, 80 μ thick, of predominantly longitudinal hyphae, 4 μ in diameter, very thickwalled, the upper third under the algal layer more loosely woven with air spaces; lower cortex 10 μ thick, of very thickwalled pale brown cells, mostly spherical and irregularly packed, with a tendency to fastigiate arrangement, 5–6 μ in diameter.

Apothecia 7–8 mm. in diameter, stipes 4 mm. tall, 2.5 mm. in diameter, longitudinally deeply rugose and subscrobiculate, margin deeply crenulate, inrolled at first; exciple infundibuliform, cream buff to chamois, smooth at first becoming reticulately rugose and subscrobiculate; disc deeply concave and imperforate becoming nearly plane and perforate, auburn; amphithecial cortex 16 μ thick, of fastigiate pseudoparenchyma, gelified, outer gel brownish; algal layer 65 μ thick, of discrete colonies with occasional cells in the medulla; algal layer under the parathecium 20 μ thick, nearly continuous; parathecium 30 μ thick, of pseudoparenchyma from periclinal hyphae 4 μ in diameter; hypothecium 20 μ thick, of slender more loosely woven hyphae; thecium 65 μ tall; paraphyses slender, simple or once dichotomous above the asci, tips not thickened, ending in the brownish epithecial gel; asci ellipsoid, 45 $\times$ 20 μ, wall and tip thickened, 8-spored; ascospores distichous, ellipsoid, 16–17 $\times$ 6–7 μ, with thick epispore.

Spermogonia abundant in the outer portions of the lobes, oblately spheroidal, 160 μ tall, 210 μ in diameter; wall blackened about the ostiole, 9–10 μ thick, of brownish very small celled periclinal pseudoparenchyma; spermatiophores 60 μ

long, septate; spermatia lateral at the septa, bacilliform, about 6 × 0.6 μ.

Small J19 has somewhat smaller lobes and broader ascospores, 16 × 8–10 μ.

ETHIOPIA: Chokke Mts. 10° 40′ N., 37° 45′ E., north of Debra Marcos, *J. N. Lythgoe 34*, C.B.E.E.; *W. J. Ballantine 73* p. p. min., C.B.E.E.; both at Kew.

KENYA: Chyulu Hills, *H. D. van Someren*, in E. African Herb.; Guaso Nyiro, *G. M. Allen 1831b*, in Dodge Herb.

UGANDA: Mt. Elgon, 1290 m., *W. Small J19* p. p.; Kigezi, saddle between Muhuvura and Mgahinga, on trees, *I. R. Dale 11b*, fragments; both at Kew.

CONGO: Kahusi, on *Arundinaria alpina*, *F. L. Hendrickx 4302b, 4305* p. p. min., sterile, in E. African Herb.

forma GLABRIOR Steiner & Zahlbr., Bot. Jahrb. [Engler] **60**:526. 1926.

Type: Tanganyika, West Usambara, between Mazumbai and Mzinga, 1100–1200 m., *Brunthaler*.

Thallus less rugose, ridges on the exciple lower, more cracked, exposing the medulla.

This form seems hardly worthy of recognition. Our Tanganyika material agrees with it.

TANGANYIKA: without locality, probably East Usambara, *Braun* ex B. L. Inst. Amani 8600, in E. African Herb.

PARMELIA (AMPHIGYMNIA) EUNETA Stirton, Scott. Nat. **4**:298. 1877-78.

Type: Cameroons, near Victoria, corticole, *G. Thomson*.

Thallus 5 cm. or more in diameter, lobes rounded about 10 mm. wide, margins crisped and lobulate, lobules up to 2 mm. long, mostly less than 0.5 mm. wide, some corniculate, tips truncate or retuse, margins ciliate, cilia slender, simple or sometimes forked near the tips, up to 3 mm. long; underside black, rugose, nude with occasional groups of simple rhizinae about 1 mm. long, ending in a thin disc holdfast 0.5 mm. in diameter, when in contact with the bark; upper cortex 13–15 μ thick, of fastigiate pseudoparenchyma, cells somewhat irregularly arranged, highly gelified, outer half pale brown, inner half hyaline; algal layer 13 μ thick, of discrete colonies of *Trebouxia*; medulla K–, C–, KC–, 25–50 μ thick, of compactly woven, thickwalled longitudinal hyphae with occasional oblique or vertical hyphae connecting the upper and lower cortices; lower cortex 13–16 μ thick, black, pseudoparenchymatous from longitudinal hyphae, extending up the sides and over the upper surface about 50 μ to join the upper cortex.

Apothecia 10 mm. in diameter, stipe 3–4 mm. tall, margin slightly crenulate, exciple infundibuliform to deeply urceolate, deeply scrobiculate, almost pseudocyphellate along the ridges; disc very concave, liver brown to chestnut and blackening in age; amphithecial cortex 35 μ thick, of fastigiate pseudoparenchyma, cells somewhat irregularly arranged; algal layer 30 μ thick, of discrete colonies, cells 5–6 μ in diameter, in places crowded, in other places widely separated; medulla loosely woven; algal layer under the parathecium 35–40 μ thick, nearly continuous; parathecium 30 μ thick, brown, of fastigiate pseudoparenchyma; hypothecium 10–15 μ thick, of slender thinwalled periclinal hyphae; thecium 110–115 μ tall; paraphyses slender, dichotomous above the asci, tips slightly clavate reaching the

surface of the epithecial gel; asci ellipsoid, 50 × 15 μ, thickwalled; ascospores ellipsoid, 20–23 × 10–13 μ.

Our material differs from the original description in having more regularly ciliate margins and the medulla C–, KC–, instead of C faint pink and KC pink. W. A. Leighton recorded the chemical reactions of his specimen of *Gustavo Mann* as completely negative some time between 1849 and his death; my own tests confirm his statement.

GHANA (Gold Coast): Ashanti C. P. Agogo, ramulicole, *T. F. Chipp 446*, at Kew.
CAMEROONS: Cameroon Mt. 2255–2575 m., without collector, sent Nyl. as no. 7 but determination not recorded, det. *P. acanthifolia* Pers. by Müller Argau, herb. Hookerianum, large plants, at Kew.
FERNANDO PO: Sta. Isabel Peak, 2835 m., *Gustavo Mann*, at Kew, duplicate ex Herb. W. A. Leighton also at Kew.

PARMELIA (AMPHIGYMNIA) SCHIMPERI Müll. Arg., Hedwigia **31**:276. 1892.

Type: Ethiopia, Debra, *Schimper 13*; Geras, *Schimper 1396*; Mt. Kubbi near Adoa, *Schimper*, none designated as type.

Thallus at least 4 cm. in diameter, deep olive buff to pale olive buff, lobes rounded, 10 mm. long, 15 mm. broad, margins sparingly short ciliate, crenate, smooth; surface smooth becoming reticulate rugose and rimulose areolate toward the center; underside black, shading to chestnut or lighter and nude at the margins, center irregularly rhizinose, rhizinae about 1 mm. long; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells thinwalled, 3–4 μ in diameter, the outer 10 μ heavily nubilated with brownish granules; algal layer 15 μ thick, nearly continuous, of single cells and small colonies of *Trebouxia*, cells 7–10 μ in diameter; medulla K–, C evanescent pink next the algal layer, negative below, KC a deeper pink next the algal layer soon fading, 80–100 μ thick, loosely woven throughout, slightly closer just under the algal layer and next the lower cortex, hyphae 4 μ in diameter, nubilated with hyaline granules just under the algal layer; lower cortex 20 μ thick, of thickwalled hyaline pseudoparenchyma, cells 6 μ in diameter, only the outermost cells with thick brownish walls.

Apothecia 6–10 mm. in diameter, substipitate and urceolate at first, margins entire, inrolled, exciple white reticulate above, becoming shallowly scrobiculate below and longitudinally rugose on the very short stipe; disc remaining concave, Sanford's brown becoming auburn; amphithecial cortex 25 μ thick, of fastigiate thinwalled pseudoparenchyma, cells 3–4 μ in diameter, the outer half heavily nubilated with red brown granules; algal layer 30 μ thick, nearly continuous, of single cells and small discrete colonies, 15 μ in diameter; medulla of moderately closely woven hyphae, heavily but irregularly nubilated with grayish granules; algal layer under the parathecium 15–20 μ thick, nearly continuous of small colonies; parathecium 25 μ thick, of fastigiate thickwalled pseudoparenchyma, lumina small below, larger and deeply staining in the upper half; hypothecium 15 μ thick, of very slender, moderately closely woven periclinal hyphae; thecium 115 μ tall; paraphyses slender, septate, simple or once dichotomous above the asci, tips not or only very slightly enlarged, ending about 10 μ below the surface of the very pale brownish epithecial gel; asci broadly clavate, 75 × 25 μ, wall 3 μ thick below, 15 μ at the tips, protoplasts rounded, 8-spored; ascospores ellipsoid, 20–24 × 10–13 μ, with a moderately thick epispore.

In *Dale L53*, the apothecium sectioned is immature, the thecium about half the normal height, with a single very deeply staining young ascus.

ETHIOPIA: north side of Mt. Kubbi, truncicole in shade, *Schimper* 26 June 1837; Simien, Mindigabsa, ramulicole, *H. Scott 323*; both at Kew.

UGANDA: Bunyoro, Busingoro, 1125 m., on bark of *Jacaranda* tree, *I. R. Dale L53*; Kigezi, Naiguru ridge, 2250–2575 m., corticole, *I. R. Dale L47* p. p. min., immature; both at Kew.

CONGO: Lugunam buga, route Kahusi, on mossy rocks, *F. L. Hendrickx 4251*, in E. African Herb.

PARMELIA (AMPHIGYMNIA) UBERRIMA Hue, Mém. Soc. Bot. France 38:9. 1916.

Type: Kenya, Blue Post on Tika River, 45 km. from Nairobi on road to Fort Hall, 1900 m., southeast of Mt. Kenya, *Poincins*.

Thallus pale glaucescent, up to 20 × 5–6 cm., peripheral lobes 10–20 mm. wide, rounded, smooth, somewhat scrobiculate in the center; margin centate to crenulate, ciliate, cilia 1–1.5 mm. long, slender, flexuous; underside black, paler at the margins, reticulate rugulose, center deeply rugose; upper cortex 20–60 μ thick, nubilated with dark yellow granules, fastigiate, outer portion decomposed; algal layer 30–40 μ thick, continuous or partly interrupted, cells 6–10 μ in diameter; medulla K yellow, KC orange, hyphae longitudinal, densely woven, 6–10 μ in diameter with calcium oxalate crystals; lower cortex hyaline near the tips of the lobes, black toward the center, 25–60 μ thick, fastigiate.

Apothecia up to 22 mm. in diameter, substipitate, margins crenulate, exciple very rugose with cilia and spermogonia; disc rufous darkening, imperforate; amphithecial cortex 60 μ thick, up to 100 μ on the ridges, fastigiate; parathecium (including hypothecium) 40 μ thick; thecium 100–110 μ tall; paraphyses 4 μ in diameter, coherent, cells 8–10 μ long, lumina 1 μ in diameter, dichotomous above the asci, tips rufous; asci 70 × 22 μ, tips slightly thickened, base short caudate; ascospores distichous, 16–20 × 9–11 μ, epispore 2 μ thick.

Spermogonial wall dark about the ostiole; spermatiophores 40–60 μ long, septate, branched; speramtia 8–10 × 1 μ, straight with truncate ends.

The above description is translated and condensed from Hue's original description, as we have no certain specimens. The Kenya specimen agrees in chemical reactions of the medulla and general habit of the thallus, but is only 80 μ thick (probably Hue prepared his sections from the thicker central part of the thallus); the upper cortex 20 μ thick, so heavily nubilated as to obscure details of structure; the algal layer is 20 μ thick, of close discrete colonies of *Trebouxia*; medulla 55 μ thick, of loosely woven longitudinal hyphae, 6–7 μ in diameter, with very few oxalate crystals; lower cortex about 15 μ thick, of dark brown, fastigiate pseudoparenchyma. Our specimen is sterile and comes from a higher elevation than the type. The Uganda specimen agrees in the structure of the apothecium; parathecium 20 μ thick, pseudoparenchymatous from periclinal hyphae; hypothecium 15–20 μ thick, of slender, loosely woven periclinal hyphae; but the medulla is K–, C–, KC–.

KENYA: west slope of Mt. Kenya, along trail from West Kenya Forest Station to summit, in giant heath zone, ca. 3630 m., *Edgar A. Mearns 1529*, T. Roosevelt Smithsonian Exp., in G. K. Merrill Herb. at Farlow Herb.

UGANDA: Mt. Elgon, 1290 m., corticole, *W. Small 217* p. p., at Kew.

PARMELIA (AMPHIGYMNIA) NEIROBIENSIS Steiner & Zahlbr., Bot Jahrb. [Engler] 60:517. 1926.

Type: Kenya, Nairobi, 1360 m., *Schroeder 287*.

Thallus 4 cm. in diameter, between buffy brown and citrine drab in the center, margins dark olive buff, lobes rounded, 10 mm. long, 13 mm. wide, margins deeply crenate, central lobes lobulate, lobules rounded, about 2 mm. long, 1.5 mm. wide with numerous spermogonia, margins smooth eciliate, neither isidiose nor sorediose, surface subcerebriform rugose in the center, smooth on marginal lobes, K yellowish, C bleached to plumbeous; underside black in the center, with close short rhizinae anchoring the thallus closely to the rough bark, marginal lobes nude, subascending, honey yellow to chamois; upper cortex 20 μ thick, surface very uneven, of fastigiate pseudoparenchyma, hyphae moniliform, thinwalled, 4 μ in diameter, uppermost cell with a thicker brownish wall, all moderately nubilated with brownish granules; algal layer 25 μ thick, of close discrete colonies of *Trebouxia*, cells 5–6 μ in diameter, an occasional cell pushing up between the cortical hyphae; medulla K–, C–, KC–, 65–115 μ thick, of moderately closely woven, longitudinal hyphae, 3–4 μ in diameter, incrusted with hyaline crystals and scattered larger crystals up to 10 $\times$ 7 μ in the air spaces; lower cortex brownish, 15 μ thick, gelified, of fastigiate pseudoparenchyma, cell lumina 2 μ in diameter.

Apothecia up to 7 mm. in diameter, stipitate, stipe 1–2 mm. tall, 2–3 mm. in diameter; margin entire becoming crenulate, inrolled at first; exciple scrobiculate, ridges low and longitudinal on the stipe; disc perforate, auburn, remaining concave; amphithecial cortex 30 μ thick, of gelified, fastigiate pseudoparenchyma, lumina 3 μ in diameter; algal layer of discrete colonies 30–50 μ in diameter with a few solitary cells deeper in the medulla; medulla of moderately closely woven periclinal hyphae in a layer 50 μ thick, the rest arachnoid; algal layer under the parathecium of close discrete colonies 20–50 μ in diameter; parathecium 30 μ thick, of gelified fastigiate pseudoparenchyma, lumina 2 μ in diameter; hypothecium 8–9 μ thick, of slender, thinwalled, periclinal hyphae, 2 μ in diameter; moderately closely woven; thecium 80 μ tall; paraphyses slender, dichotomous above the asci, tip not thickened, ending about 6 μ below the surface of the hyaline epithecial gel; asci clavate, 65 $\times$ 20 μ, wall 3.5 μ thick, tip not thicker, 8-spored; ascospores 12–14 $\times$ 7–8 μ, broadly ellipsoid, with a moderately thick epispore.

Dale L51 has a somewhat smaller thallus, probably due to growing on twigs and small branches, with somewhat smaller peripheral lobes. *Eyles 823* is smaller and sterile but agrees otherwise.

ETHIOPIA: Bagla, 1610 m., corticole, *J. M. Hildebrandt*, July 1872, sub *P. abessinica* ex herb. Sbarbaro at Farlow Herb.

KENYA: Northern Frontier Province, Dandu, 3° 26′ N., 39° 54′ E., 1127 m., on trees, *J. B. Gillett 12691*, at Kew; northeast slope of Mt. Elgon, 2575 m., *A. Burnet L30a*; North Kajiado, *A. Burnet L33*, both in Makerere College Herb.

UGANDA: Bunyoro, Busingoro, 1130 m., on *Poinsettia* bark, *I. R. Dale L51*, on *Jacaranda* bark, *I. R. Dale L69* p. p. min.; Kigezi, Naiguru Ridge, 2250–2575 m., corticole, *I. R. Dale L47*; Mafuga, 2415 m., corticole, *I. R. Dale L50* p. p. min., all at Kew; northwest Longido, *A. Burnet L46*, Makerere College Herb.

TANGANYIKA: Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna* sp., *A. A. Bullock 1871* p. p. min., International Red Locust Control Service, at Kew.

SOUTHERN RHODESIA: Makoni District, 1550 m., *Frederick Eyles 823*, at Kew.
ANGOLA: nordeste da Lunda, Dundo near Rio Luachima, 750 m., on small branches of tall trees of gallery wood, *J. Gossweiler 13928* p. p. min., Explorações da Companhia de Diamantes, at Kew.

PARMELIA (AMPHIGYMNIA) **Thomasii** Dodge, sp. nov.

Type: Uganda, Mt. Otse, West Nile, 1610 m., on tree branches at rocky summit, *A. S. Thomas 1962*, at Kew.

Thallus ad 7 cm. diametro, obscure griseo-olivaceus vel pallidior, laevis, reticulatim rimulosus, lobis rotundatis, marginibus crispatis, eciliatis, partim sparse lobulatis, lobulis 1 mm. longitudine latitudineque, apicibus plus minusve truncatis; infra niger, marginibus late cinnamomeo-alutaceis, reticulatim rugosus, sine rhizinis typicis, hapteris 1 mm. diametro, ramosis, in centro thalli; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5 μ diametro, granulis griseis nubilatis; stratum algarum 25 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 10 μ diametro; medulla K–, C–, KC–, 30–100 μ crassitudine, hyphis longitudinalibus 5 μ diametro, dense intertextis; cortex inferior 20 μ crassitudine, niger, pseudoparenchymaticus ex hyphis longitudinalibus, cellulis 5 μ diametro.

Apothecia ad 20 mm. diametro, stipite 2 mm. altitudine atque latitudine, sulcato, margine laevis, primo inflexo dein in lobis 4 mm. longitudine, latitudine variabili; excipulo reticulatim rugosus, disco concavo dein plano, perforato, castaneo-brunneo; cortex amphithecialis 25 μ crassitudine, fastigiatus, dimidia parte extera brunea, gelifacta; stratum algarum coloniis discretis ad 50 μ diametro; stratum algarum sub parathecio coloniis discretis sed compactioribus, 30 μ diametro; parathecium 25 μ crassitudine, pseudoparenchymaticum ex hyphis pachydermeis, periclinalibus conglutinatis; hypothecium 10–15 μ crassitudine, hyphis leptodermeis periclinalibus laxe intertextis; thecium 80 μ altitudine; paraphyses tenues, septatae, bis terve dichotomae super ascos; ramis submoniliformibus, cellula ultima subclava; asci ellipsoidei, ca. 65 $\times$ 25 μ, pachydermei, apicibus incrassatis; ascosporae octonae (frequenter 4 ascosporis abortis), episporio crasso, 14–16 $\times$ 10 μ.

Thallus up to 7 cm. in diameter, deep grayish olive to light grayish olive, surface smooth, reticulate rimulose, deeply rimose in older portions where it may be slightly rugose, lobes rounded, margins crisped, eciliate, some entire, others sparsely lobulate, lobules about 1 mm. long, less than 1 mm. wide, tips truncate; underside with cinnamon buff margins, deeply reticulate rugose, typical rhizinae absent, holdfast about 1 mm. in diameter, formed of branched fibers resembling small haptera in the Umbilicariaceae, scattered over the central portion of the thallus; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 5 μ in diameter, very heavily nubilated with grayish granules; algal layer 25 μ thick, of discrete colonies of *Trebouxia*, from close to scattered, cells up to 10 μ in diameter; medulla K–, C–, KC–, 30–100 μ thick, of closely woven, longitudinal hyphae 4–6 μ in diameter with small air spaces under the ridges of the lower cortex; lower cortex 20 μ thick, black, pseudoparenchymatous from longitudinal hyphae, cells 6 μ in diameter.

Apothecia up to 20 mm. in diameter, stipe 2 mm. tall, 2 mm. in diameter, margin entire, inrolled at first, splitting into lobes 4 mm. long, of variable widths;

exciple very deeply and minutely reticulate rugose, cortex not cracking along the ridges; disc very concave becoming plane and perforate, chestnut brown; amphithecial cortex 25 μ thick, fastigiate, the outer half deep brown, gelified; algal layer of discrete colonies 50 μ in diameter; algal layer under the parathecium of close discrete colonies 30 μ in diameter; parathecium 25 μ thick, pseudoparenchymatous from conglutinate, moderately thickwalled, periclinal hyphae; hypothecium 10–15 μ thick, of loosely woven periclinal hyphae; thecium 80 μ tall; paraphyses slender, septate, twice or thrice dichotomous above the asci, branches somewhat moniliform, terminal cell slightly clavate ending in the brownish epithecial gel; asci ellipsoid, 65 $\times$ 25 μ, 8-spored at first but often about 4 spores abort, very thickwalled with a thicker tip; ascospores ellipsoid, 14–16 $\times$ 10 μ, with a moderately thick epispore.

At first sight this species looks like a very large *Leptogium*.

UGANDA: Mt. Otse, West Nile, 1610 m., on tree branches at the rocky summit, *A. S. Thomas 1962*, type; Kigezi, Naiguru ridge, 2415 m., corticole, *I. R. Dale L49*; Mafuga, 2415 m., *I. R. Dale L50*, all in Kew.

PARMELIA (AMPHIGYMNIA) **litoralis** Dodge, sp. nov.

Type: Kenya, Kilifi, on coastal rocks, *Matt Cass*, com. P. R. O. Bally, Scott Agr. Lab., at Kew, duplicate in E. African Herb.

Thallus 4 cm. diametro, dilute olivaceo-alutaceus, lobis rotundatis, 10 mm. longitudine latitudineque, marginibus dentatis lobulatisve, lobulis 1 mm. longitudine latitudineque, apicibus truncatis rotundatisve, eciliatis, tenuiter nigromarginatis; inferne niger, minute reticulatim rugulosus, rhizinis brevibus; cortex superior 15 μ crassitudine, fastigiatus, hyphis 4 μ diametro, granulis brunneis nubilatis; depressionibus strato amorpho 15 μ crassitudine tectis; stratum algarum 15 μ crassitudine, coloniis parvis cellulisque sparsis *Trebouxiae*, 4–6 μ diametro; medulla K–, C–, KC–, 110–115 μ crassitudine hyphis longitudinalibus 4–5 μ diametro intertextis, paucis cum hyphis verticalibus, granulis brunneis nubilatis; infra hyphis laxius intertextis; cortex inferior niger, 20–30 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 7–8 μ diametro.

Apothecia 4–5 μ diametro, marginibus inflexis crenulatisque, excipulo laevi, disco concavo, subaurantiaco; cortex amphithecialis 55 μ crassitudine, fastigiatus, gelifactus, hyphis 8–9 μ diametro, granulis brunneis nubilatis; stratum algarum coloniis discretis, 15 μ diametro; medulla arachnoidea; stratum algarum sub parathecio 25–30 μ crassitudine, coloniis discretis; parathecium 30 μ crassitudine, pseudoparenchymatice fastigiatum, cellulis 3–4 μ diametro; hypothecium 8 μ crassitudine, gelifactum, hyphis periclinalibus; thecium 80 μ altitudine; paraphyses tenues, sparsim septatae, cellula ultima subclavata; asci clavati, 60 $\times$ 22–23 μ, membrana 3 μ crassitudine, apice 6 μ; ascosporae octonae (frequenter 4 ascosporis abortis) ellipsoideae, 16 $\times$ 10 μ (in ascis 4-sporis 18–20 $\times$ 10–12 μ), episporio 2.5 μ crassitudine.

Thallus fragment 4 cm. in diameter, probably larger, pale olive buff, lobes rounded, 10 mm. wide and long, margin dentate to lobulate, lobules about 1 mm. long and wide, tips rounded or truncate, eciliate, narrowly black margined; underside black to the margins, minutely reticulate rugulose; rhizinae mostly torn away in removing from the rock, very short, stout, ending in a disciform holdfast up to

1 mm. in diameter; upper cortex 15 μ thick, fastigiate, hyphae 4 μ in diameter, heavily nubilated with brownish granules, in the depressions covered by an amorphous layer up to 15 μ thick; algal layer 15 μ thick, of solitary cells and small colonies of *Trebouxia*, cells 4–6 μ in diameter; medulla K–, C– or very faint yellow, KC–, 110–115 μ thick, of moderately closely woven longitudinal hyphae, 4–5 μ in diameter, with some vertical hyphae, heavily nubilated with brownish granules except in the lower 15–30 μ where it is loosely woven with air spaces; lower cortex 20–30 μ thick, black, of fastigiate pseudoparenchyma, cells 7–8 μ in diameter.

Apothecia 4–5 mm. in diameter, remaining urceolate with inrolled crenulate margins, exciple smooth, disc concave between Mars orange and burnt sienna; amphithecial cortex 55 μ thick, gelified, fastigiate, hyphae 8–9 μ in diameter, nubilated with brownish granules in the outer 15 μ; algal layer 15 μ thick, of discrete colonies, heavily nubilated with brownish granules; medulla arachnoid, with air spaces 100 μ in diameter below, moderately closely woven above; algal layer under the parathecium 25–30 μ thick, of discrete widely spaced colonies, dying out in places; parathecium 30 μ thick, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter, lumina 1 μ below, 2–3 μ in diameter in the upper 10–12 μ and the surrounding gel staining with phloxine; hypothecium 8 μ thick, gelified, of slender periclinal hyphae, close above, less so below; thecium 80 μ tall; paraphyses slender, sparsely septate, simple or once dichotomous near the tips, terminal cell slightly clavate, ending 4–6 μ below the surface of the brownish epithecial gel; asci clavate, 60 $\times$ 22–23 μ, wall 3 μ thick, tips 6 μ, 8-spored at first but often only 4 spores mature; ascospores 16 $\times$ 10 μ in 8-spored asci, 18–20 $\times$ 10–12 μ in 4-spored asci, ellipsoidal, epispore 2.5 μ thick.

KENYA: Kilifi, on coastal rocks, *Matt Cass*, com. P. R. O. Bally, Scott. Agr. Lab., type, at Kew and duplicate in E. African Herb.

PARMELIA (AMPHIGYMNIA) APPENDICULATA Fée, Suppl. Essai Crypt. Ecorces Officin. 118. 1837; Nyl., Syn. Meth. Lich. 1:381. 1860.

Type: Réunion, ramicole.

Thallus up to 12 cm. in diameter, olive buff, lobes irregular dichotomous with rounded sinuses, peripheral lobes rounded up to 10 mm. long and wide, margins crenate with either acute or rounded sinuses, cilia rather close, 2–3 mm. long; central lobes variously lobulate, the longer 4–5 mm. long, 0.4–0.5 mm. wide, once or twice dichotomous, convex, the shorter simple with revolute margins, corniculate, tips rounded; underside black, shining, margins nude, Brussels brown, lobules light ochraceous buff at the tips; rhizinae stout, short, dense in groups 3 mm. in diameter; upper cortex 25 μ thick, of fastigiate pseudoparenchyma, hyphae 6–7 μ in diameter, heavily nubilated with greenish brown granules; algal layer up to 15 μ thick, of discrete small colonies of *Trebouxia* and single cells 5–6 μ in diameter, somewhat nubilated; medulla K–, C–, KC–, 35–50 μ thick, of loosely woven hyphae 3 μ in diameter, slightly nubilated, with about as many vertical as longitudinal hyphae; lower cortex 20 μ thick, of fastigiate pseudoparenchyma.

Apothecia 8–12 mm. in diameter, pedicellate, margins lobulate-fimbriate, exciple scrobiculate, rufescent, disc dark rufous fuscescent; ascospores 27–31 $\times$ 11–18 μ.

As our specimen is sterile, the description of apothecia is translated from Nylander, *l.c.*

MAURITIUS: without locality or collector, com. C. H. Peck 4 to Tuckerman in 1869, now in Tuckerman Herb. sub *P. perlata* v. *ciliata*, f. *dissecta*, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) NITENS Müll. Arg., Bot. Jahrb. [Engler] **20**:255. 1894.

Type: Tanganyika, Usambara, Bukoba District, lake region, *Stuhlmann 4*.

Thallus up to 14 cm. in diameter, mostly deep olive buff, some peripheral lobes bleached to pinkish buff, others not; peripheral lobes up to 2 mm. long, 10 mm. wide below, expanding to 20 mm. wide above, deeply crenate into 3 rounded lobes, somewhat crisped, central lobes smaller, deeply crenate, forming lobules 1–2 mm. wide and long, margins revolute, tips rounded, with microphylline lobules regenerating from injury; surface smooth, subnitid on peripheral lobes, shallowly reticulate rugose and somewhat rimulose areolate in the central portion; underside black, minutely reticulate rugulose, margins variously snuff brown, bister and sayal brown, central rhizinae short, stout, black, several uniting in a common holdfast 1–2 mm. in diameter, groups in center of paler peripheral lobes short pale, subpellucid where not making contact with the substrate; upper cortex 10 μ thick, of fastigiate pseudoparenchyma, cells 3 μ in diameter, heavily nubilated with brownish granules; algal layers of discrete colonies of *Trebouxia*, 20–25 μ in diameter, cells 7–10 μ in diameter, heavily nubilated with brownish granules; medulla K–, C pink, KC–, 65–70 μ thick, of closely woven, longitudinal hyphae 2–3 μ in diameter, with some small air spaces, irregularly nubilated with grayish brown granules; lower cortex 10 μ thick, of fastigiate pseudoparenchyma, cells 3 μ in diameter, lumina 1 μ, outermost cells with very dark walls and nubilated, inner cells with paler walls without granules.

Apothecia 10 (–15) mm. in diameter, urceolate with entire inrolled margins, finally flattened by splitting into segments; exciple smooth finally shallowly reticulate rugulose with predominantly radial ridges, disc imperforate, auburn, smooth becoming bullate and subrugose in old flattened apothecia; amphithecial cortex 20–25 μ thick, of fastigiate pseudoparenchyma, cells 3 μ in diameter, outer half heavily nubilated with brownish granules, inner half hyaline; algal layer 30 μ thick, nearly continuous, cells 6–7 μ in diameter; medulla moderately closely woven; algal layer under the parathecium 15 μ thick, continuous; parathecium 25 μ thick, of gelified pseudoparenchyma from periclinal hyphae, protoplasts about 3 μ in diameter; hypothecium 15 μ thick, of slender, branched periclinal hyphae, rather loosely woven; thecium 65–70 μ tall; paraphyses slender, septate, dichotomous above the asci, branches moniliform, tips not enlarged, ending about 10 μ below the surface of the brownish epithecial gel; asci clavate, 52 $\times$ 23 μ, wall 3 μ thick, tips 4–5 μ, 8-spored; ascospores short ellipsoid, 10–12 $\times$ 8–9 μ, epispore 1.5–2 μ thick.

Dale L54 was badly eaten by insects, losing most of the upper cortex and some of the lower cortex.

UGANDA: Bunyoro, Busingoro, 1130 m., on bark of old *Jacaranda* tree, *I. R. Dale L54*,

L68a; Toro District, Fort Portal, 1775 m., on *Eucalyptus tereticornis, I. R. Dale L38* p. p.; same locality and substrate but 1625 m., *I. R. Dale L44*; all at Kew.

NYASALAND: without locality, a fragment, *L. J. Brass 2,* Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (AMPHIGYMNIA) **ramulicola** Dodge, sp. nov.

Type: Madagascar, on decorticate twigs, *J. M. Hildebrandt,* sub *P. acanthifolia,* ex herb. Sbarbaro, at Farlow Herb.

Thallus ramulicola, 5 × 2.6 cm., dilute ochraceo-alutaceus, monophyllus, marginibus eciliatis, alte crenatis, lobulis 2 mm. longitudine, 1–4 mm. latitudine; infra sepiaceus, marginibus ochraceo-alutaceis, rhizinae 0.3 mm. longitudine; cortex superior 30 μ crassitudine, fastigiatus, hyphis 3–4 μ diametro, cellulis superiores 5 μ diametro, 5–10 μ longitudine; stratum algarum 15 μ crassitudine, continuum, cellulis 6–7 μ diametro, nubilatis; medulla K–, C–, KC–, 80 μ crassitudine, sub strato algarum subarachnoidea, infra hyphis longitudinalibus, 3 μ diametro, granulis griseis nubilatis; cortex inferior 7 μ crassitudine, cellulis pachydermeis, 7 μ diametro.

Apothecia ad 6 mm. diametro, sessilia, marginibus integris subcrenatisve, excipulo laevi, disco brunneo imperforato; cortex amphithecialis 50 μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 20 μ crassitudine, continuum, cellulis 7 μ diametro; medulla laxe contexta; stratum algarum sub parathecio 50 μ crassitudine; parathecium 30 μ crassitudine, fastigiatum, hyphis 7 μ diametro; hypothecium 35 μ crassitudine, hyphis pachydermeis, gelifactis, 3 μ diametro, luminibus 1 μ; thecium 65 μ altitudine; paraphyses tenues, dichotomae super ascos, ramis submoniliformibus, apicibus clavatis, 6 μ diametro; asci clavati, 40 × 12–13 μ, pachydermeis; ascosporae octonae, ellopsoideae, 9–10 × 4–5 μ, episporio crasso.

Thallus monophyllous, completely investing decorticate twigs, margins slightly overlapping, very closely appressed throughout, 5 cm. long, 26 mm. wide, pale ochraceous buff, margins eciliate, entire in places or very deeply crenate, cutting the margin into lobules 1–4 mm. wide, about 2 mm. long, surface rugose in the center, K yellow, mouths of spermogonia scarlet, margins smooth; underside sepia in the center, abruptly pale ochraceous buff toward the margins, dark portion verrucose, pale portion smooth, opaque; rhizinae close in small groups, 0.3 mm. long, forming holdfasts at their tips; upper cortex 30 μ thick, the upper 10 μ a palisade of brownish cells 10 × 5 μ, or two cells 5 μ in diameter, nubilated with brownish granules, the rest of dichotomous vertical hyphae 3–4 μ in diameter, with scattered algal cells pushing up between the hyphae; algal layer continuous, 15 μ thick, of moderately closely packed cells 6–7 μ in diameter, very heavily nubilated; medulla K–, C–, KC–, 80 μ thick, almost arachnoid with large air spaces under the algal layer, more closely woven below, of longitudinal hyphae 3 μ in diameter, heavily but very irregularly nubilated with grayish granules except in the lower 15 μ; lower cortex 7 μ thick, a single layer of cells with thick, very pale brown walls.

Apothecia up to 6 mm. in diameter, sessile, urceolate at first, flattened in the middle but margins erect, entire to subcrenate, exciple smooth, radially rugose

below; disc imperforate, auburn or darker; amphithecial cortex 50 μ thick, fastigiate, the outer half of hyphae 7 μ in diameter, protoplasts ellipsoidal 7 $\times$ 3 μ, the inner half of vertical, septate hyphae, protoplasts 2 μ in diameter; algal layer 20 μ thick, continuous, cells 7 μ in diameter, not closely packed; medulla loosely woven with large air spaces; algal layer under the parathecium 202 μ thick, parathecium 30 μ thick, fastigiate, hyphae 7 μ in diameter, lumina 1 μ; hypothecium 35 μ thick, gelified, of periclinal hyphae 3 μ in diameter, lumina 1 μ; thecium 65 μ tall; paraphyses slender, dichotomous above the asci, branches submoniliform, terminal cells clavate, 6 μ in diameter, reaching the surface of the brownish epithecial gel; asci clavate, 40 $\times$ 12–13 μ, wall 3 μ thick, tip 4 μ, protoplast mamillate when young, 8-spored; ascospores ellipsoidal, 9–10 $\times$ 4–5 μ, with a thick epispore.

MADAGASCAR: on decorticate twigs, *J. M. Hildebrandt,* sub *P. acanthifolia,* ex herb. Sbarbaro, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) SOYAUXII Müll. Arg., Linnaea **63**:32. 1880.

Type: Angola, Pungo Andongo, saxicole, *Soyaux.*

Thallus more than 11 cm. in diameter, 130–150 μ thick, pale olive buff, K yellow, lobes up to 20 mm. wide, suberect, crisped, margins crenate, smooth, rimulose in the older portions, white reticulate; underside black, minutely rugulose; rhizinae few, simple or branched at the tips forming the holdfasts; upper cortex 15 μ thick, of thinwalled pseudoparenchyma, about 2 cells thick, heavily incrusted with yellowish granules; algal layer 30 μ thick, continuous, cells of *Trebouxia* 5–6 μ in diameter; medulla K–, C red, KC–, 80 μ thick, of loosely woven longitudinal hyphae, 3 μ in diameter, more closely woven next the lower cortex; lower cortex 12–15 μ thick, of septate brown conglutinate hyphae, sometimes cracking away and leaving the lower portion of the medulla to form a pale buff pseudocortex.

Apothecia, up to 35 mm. in diameter, stipe 10 mm. tall, 4 mm. in diameter, margin inrolled, crenate, exciple smooth to very slightly rugulose, disc auburn, deeply concave at first becoming nearly plane, perforate in old apothecia; amphithecium extending about 0.5 mm. beyond the thecium; amphithecial cortex 25 μ thick, fastigiate, of relatively thinwalled pseudoparenchyma; algal layer 15 μ thick, continuous; medulla closely woven, heavily nubilated with hyaline granules in a layer 15 μ thick below the algal layer; algal layer under the parathecium 15–20 μ thick, continuous; parathecium gelified, 20 μ thick, of periclinal hyphae; hypothecium 10–12 μ thick, of slender periclinal hyphae; thecium 55–60 μ tall; paraphyses slender, septate, tips slightly clavate reaching the surface of the brownish epithecial gel; asci clavate, 40 $\times$ 20 μ, wall about 2 μ thick, tips thicker, 8-spored; ascospores ellipsoidal, 12–16 $\times$ 7–8 μ, with a thick epispore.

Spermogonia oblate spheroidal, 105 μ tall, 130 μ in diameter, immersed in the medulla, neck about 15 μ long, 25 μ in diameter, wall wholly carbonaceous at maturity, pseudoparenchymatous; spermatiophores simple or dichotomous near the base, 20 $\times$ 1 μ; spermatia cylindric, straight, 16–18 $\times$ 1 μ.

When the thecium is eaten away by insects, the parathecium functions as a cortex, concolorous with the thallus. In *Tindall M5976* the thallus is somewhat distorted from being completely wrapped around the crotch of a branch about

1 cm. in diameter. The Gossweiler fragments are old, the thecia eaten away from most of the large apothecia, and the medulla is KC red.

SIERRA LEONE: Sugar Loaf Mt., on dead tree, *H. D. Tindall* com. F. C. Deighton M5976; Picket Hill, 740 m., *T. S. Jones* com. F. C. Deighton M4592; both at Kew.

CÔTE D'IVOIRE: Moyenne, triangle aride de Toumodi, Bouallé, sur de Boka de Titi-èkro, corticole, *Guy Roberty 12673* p. p. min. in Conservatoire Bot. Genève.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler*, fragments, at Kew.

UGANDA: Sese, Towa forest, 1225 m., on rocks in grassland, *A. S. Thomas 3028*; E. Tropical Africa between 2° and 7° S., without more definite locality, *James Hannington*; both at Kew.

PARMELIA (AMPHIGYMNIA) **Robertyi** Dodge, sp. nov.

Type: Côte d'Ivoire, Moyenne, triangle aride de Toumodi, Bouallé, Boka de Titièkro, *Guy Roberty 13941*, in Conservatoire Bot. Genève.

Thallus 9 cm. diametro, inter obscure olivaceo-alutaceus et fumosus, lobis peripheric is 20 mm. diametro, rotundatis, marginibus subcrispatis; lobis centralibus subdentatis, lobulatis, eciliatis, sine isidiis sorediisque; infra niger, minute reticulatim rugulosus, marginibus fulvo-olivaceis, laevibus, nitidis, rhizinis brevibus, densis in areolis sparsis, apicibus ramosis; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5–6 μ diametro, granulis brunneis nubilatis; stratum algarum 30 μ crassitudine, subcontinuum, coloniis *Trebouxiae*, cellulis 5–6 μ diametro; medulla K flava dein aurantiaca, C–, KC–, 80 μ crassitudine, hyphis longitudinalibus laxe intertextis; cortex inferior 30 μ crassitudine, fastigiatus, gelifactus.

Apothecia submarginalia in lobis centralibus, 20 mm. diametro, stipite 3–4 mm. altitudine, 4 mm. diametro, longitudinaliter subrugoso; margine integro, excipulo subimpresso, minute albo-reticulato; disco perforato, brunneo; cortex amphitheci-alis 25 μ crassitudine, fastigiatus, gelifactus; stratum algarum 25 μ crassitudine, coloniis discretis cellulisque sparsis; medulla arachnoidea; stratum algarum sub parathecio 30 μ crassitudine, continuum; parathecium 40 μ crassitudine, pseudoparenchymaticum ex hyphis periclinalibus; hypothecium vix evolutum; thecium 95 μ altitudine; paraphyses tenues, septatae, semel bisve dichotomae super ascos, ramis submoniliformibus, apicibus anguste clavatis; asci late clavati subcylindricive 40 $\times$ 13 μ; ascosporae octonae, distichae, late ellipsoideae, 13–14 $\times$ 7–8 μ.

Thallus 9 cm. in diameter, probably larger, between deep olive buff and smoke gray, peripheral lobes 20 mm. in diameter, rounded, margins entire, somewhat crisped, central lobes somewhat dentate to lobulate, without cilia, isidia or soredia, surface smooth not rimulose, or finally slightly so in the central portion; underside black, reticulate rugulose, margins tawny olive or somewhat lighter, nearly smooth and shining; rhizinae central, short dense in scattered groups, tips closely branched to form holdfasts in contact with the bark; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with brownish granulies; algal layer 30 μ thick, subcontinuous from colonies of *Trebouxia*, cells 5–6 μ in diameter, less densely packed than in most species; medulla K yellow then orange, fading slowly, C–, KC–, 80 μ thick, of predominantly longitudinal hyphae, rather

loosely woven; lower cortex 30 μ thick, highly gelified but apparently fastigiate with a few included granules, only slightly brownish in section.

Apothecia submarginal on the central lobes, 20 mm. in diameter, stipe 3–4 mm. tall, 4 mm. in diameter, shallowly longitudinally rugose; margin entire, exciple somewhat impressed, minutely white reticulate, disc perforate, Dresden brown; amphithecial cortex 25 μ thick, gelified, fastigiate; algal layer 25 μ thick, of discrete small colonies and single cells; medulla very loosely woven and tearing on sectioning; algal layer under the parathecium 30 μ thick, continuous, with scattered cells deeper in the medulla; parathecium 40 μ thick, pseudoparenchymatous from moderately thickwalled periclinal hyphae; hypothecium scarcely differentiated, but the upper 6–8 μ of the parathecium less gelified with thinner walls; thecium 95 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches submoniliform, tips narrowly clavate, ending in the brownish epithecial gel; asci subcylindric to broadly clavate, 40 $\times$ 13 μ, wall and tip thickened when young, becoming thinwalled, at maturity, 8-spored; ascospores distichous, ellipsoidal, 13–14 $\times$ 7–8 μ, with a rather thin epispore.

This species belongs to the group of *P. Soyauxii*, but with a taller thecium, almost no hypothecium, a thicker parathecium and thinner walled asci and ascospores. It also differs in chemical reactions of the medulla.

SIERRA LEONE: without locality, *Charles Barter*; Ksballa 385 m., *N. W. Thomas 2192*; Falaba, on *Nispera* sp., *D. Small 450*; all at Kew.

CÔTE D'IVOIRE: Moyenne, triangle aride de Toumodi, Bouallé, Boka de Titièkro, *Guy Roberty 13941*, in Conservatoire Bot. Genève.

PARMELIA (AMPHIGYMNIA) ZAMBESICA Müll. Arg., Verhandl. Zool. Bot. Ges. Wien **43**:296. 1893.

Parmelia africana v. *zambesica* Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:535. 1926.

Type: Northern Rhodesia, near Boroma, *Menyhart 268, 269, 475*.

Thallus at least 9 cm. in diameter, between chamois and cream buff, peripheral lobes up to 25 mm. long, 15 mm. wide, irregularly dichotomous with rounded sinuses, ultimate lobules rounded about 4 mm. in diameter, margins subascending, crisped, sinuate, smooth, eciliate; surface smooth, opaque, slightly rugulose toward the center; underside black, shading to between Sanford's brown and auburn, very minutely rugulose; rhizinae in small dense groups, up to 1 mm. long when not making contact with the substrate, stouter and shorter forming small disc holdfasts when in contact; upper cortex 25 μ thick, fastigiate, terminal cells 12 $\times$ 6 μ, heavily nubilated with brownish granules, dichotomous below, hyaline; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 4–5 μ in diameter, heavily nubilated with brownish granules; medulla K– or very faintly yellowish, C–, KC– or very faintly yellowish, 100 μ thick, of closely woven longitudinal hyphae, 4–5 μ in diameter, very heavily nubilated with brownish granules; lower cortex black, 20 μ thick, of fastigiate pseudoparenchyma, cells 3 μ in diameter with very dark brown, moderately thick walls.

Apothecia up to 14 mm. in diameter, urceolate then expanded but remaining cupulate, margin entire or minutely crenulate, exciple smooth, then slightly and minutely impressed and shallowly reticulate rugulose, disc auburn; amphithecial

cortex 115 μ thick, of gelified fastigiate pseudoparenchyma, cells 10 μ in diameter, the outer half somewhat nubilated with brownish granules; algal layer 40–50 μ thick, continuous, very heavily nubilated with brownish granules, cells 6–7 μ in diameter; medulla closely woven, very heavily nubilated with brownish granules; algal layer under the parathecium 30 μ thick, continuous, heavily nubilated with brownish granules; parathecium 40 μ thick, of fastigiate pseudoparenchyma, protoplasts about 3 μ in diameter, somewhat irregularly arranged, gel deeply staining with phloxine, some algal cells pushing up between the hyphae in the lower 15 μ; hypothecium 55 μ thick, of periclinal gelified hyphae in the lower half, lumina about 2 μ in diameter, bending upward to the thecium in the upper half; thecium 100 μ tall; paraphyses slender, sparsely septate, dichotomous above the asci, branches slightly moniliform, terminal cells not enlarged, ending 10–12 μ below the surface of the epithecial gel; asci clavate, 65 $\times$ 20 μ, wall 2 μ thick, tips 3–4 μ, 8-spored; ascospores ellipsoidal, 16 $\times$ 8 μ, with a very thin epispore.

TANGANYIKA: Mulinda forest, southeast of Tukuyu (New Langenberg), 900 m., growing over roots of *Rangaenia muscicola* (orchid) on bark, *A. Stolz 2577A*, at Kew.

PARMELIA (AMPHIGYMNIA) HYPORYSALEA Vainio, Bot. Mag. Tokyo **35**:47. 1921.

Parmelia olivetorum v. *hyposysalea* Vainio, Cat. Welwitsch African Pl. **2**:399. 1901.

Type: Angola, Huila, Morro de Lopolo, 1225–1775 m., *Welwitsch 6, 27*; Lake of Great Hippopotamus or Ivantala, *Welwitsch 26*; Serra da Chela, *Welwitsch 28*; none designated as type.

Thallus 10 cm. in diameter, deep olive to dark olive buff, lobes 10 mm. long, 5 mm. wide at the base, expanding to 20 mm. wide above, rounded, crisped, surface smooth to minutely rugulose in the center, margins microphylline, lobules about 1 mm. wide and long; underside black with cinnamon brown margins; rhizinae rare, coarse, 1 mm. long; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, very heavily nubilated with grayish granules in a brownish gel; algal layer 15–20 μ thick, of discrete colonies of *Trebouxia*, sometimes close, sometimes widely spaced, cells 6–7 μ in diameter, with an occasional cell deeper in the medulla; medulla K–, C red, KC red, 100 μ thick, of loosely woven, moderately thickwalled hyphae, 3–4 μ in diameter, closer and more longitudinal next the lower cortex; lower cortex 15 μ thick, of deep brown, conglutinate, thickwalled hyphae.

Apothecia submarginal, up to 30 mm. in diameter, stipe 5–7 mm. tall, about 5 mm. in diameter when mature, deeply scrobiculate with predominantly longitudinal ridges; margins entire becoming crenulate and finally microphylline in very old apothecia; exciple deeply reticulate rugose below, smooth above, disc mummy brown, urceolate at first, becoming nearly plane at maturity; amphithecial cortex 80 μ thick, fastigiate, of very thickwalled, conglutinate hyphae, deep brown in the outer 25 μ, hyaline within; algal layer 25–30 μ thick, of discrete colonies, mostly close; algal layer under the parathecium 30–35 μ thick, with an occasional cell deeper in the medulla, subcontinuous; parathecium 30–35 μ thick, of fastigiate thickwalled pseudoparenchyma, lumina somewhat larger and more deeply staining in the upper half; hypothecium 15 μ thick, of thinwalled periclinal hyphae, closely interwoven; thecium 60 μ tall; paraphyses slender, septate, more closely so

above, terminal cells clavate, heavily nubilated with grayish granules in the deep brown epithecial gel; asci broadly clavate, becoming ellipsoid, 42 × 14 μ, thick-walled, 8-spored but sometimes less than 8 mature; ascospores 13–16 × 6–7 μ (15–18 × 8–10 μ, fide Vainio).

Gossweiler 1725 agrees with Vainio's brief description except in medullar reaction C red in the original description, practically negative in ours with just a trace of red under the algal layer, and slightly larger spores; perhaps Vainio's measurements were taken of spores from asci with fewer than 8 spores. The medulla of *Bullock 2103* gives a clear C red reaction next the algal layer, but is practically negative next the lower cortex; *Bullock 1871* gives C red, KC red throughout but the color slowly fades.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler 1725*, at Kew.

TANGANYIKA: Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna* sp., *A. A. Bullock 1871* p. p. min., International Red Locust Control Service, at Kew.

NORTHERN RHODESIA: Abercorn, on roots of *Tridactyle* sp. on *Brachystegia taxifolia*, in dense shade of crown, *A. A. Bullock 1108, 2103 pars*, International Red Locust Control Service, at Kew.

PARMELIA (AMPHIGYMNIA) AFRICANA Müll. Arg., Flora **63**:265. 1880.

Parmelia abessinica v. *nuda* Müll. Arg., Flora **62**:289. 1879.

Type: Southwest Sudan, Djur, Dem Sekir and Scriba Ghattas, lignicole, *Schweinfurth*. The description below based on portion of the latter collection, at Farlow Herb.

Thallus at least 10 cm. in diameter, probably larger, between citrine drab and dark olive buff, lobes imbricate, about 10 mm. wide, 20 mm. long, rounded, somewhat crisped, sinuses somewhat excised, surface smooth, margin entire narrowly black margined; central portion deeply rugose; underside black in the center, shading to russet margins, rugose with very few coarse rhizinae; upper cortex 20 μ thick, fastigiate in the upper 13 μ, heavily nubilated with brown granules, less regular and hyaline below; algal layer of discrete colonies of *Trebouxia*, 15 μ in diameter, rather scattered in the lobes sectioned, cells 5 μ in diameter; medulla K–, C deep pink, KC deep pink, soon fading, 80 μ thick, of moderately close woven mostly longitudinal hyphae 5–6 μ in diameter, lumina about 1 μ; lower cortex 15 μ thick, fastigiate, of a single layer of conglutinate, thickwalled cells 15 × 7 μ.

Apothecia pedicellate when young, 7–10 mm. in diameter, margin entire to slightly crenate, exciple smooth to slightly impressed, disc auburn or darker; amphithecial cortex 30 μ thick, fastigiate, brownish throughout; algal layer 25 μ thick, of closely packed colonies, nearly continuous at the margin, with an occasional algal cell penetrating the cortex; algal layer under the parathecium 35 μ thick, continuous or nearly so; parathecium 35 μ thick, with papilliform projections extending downward another 50 μ, pushing the algal layer down into the loose medulla, of very thickwalled, fastigiate pseudoparenchyma; hypothecium 15 μ thick, of gelified periclinal hyphae, not staining; thecium 80 μ tall; paraphyses slender, twice or thrice dichotomous above the asci, tips clavate, brownish, 10 × 4 μ, reaching the surface of the brownish epithecial gel; asci cylindric clavate, 50 × 22 μ, walls 3 μ thick, tips 7 μ when young, 8-spored; ascospores ellipsoid, 15–23 × 7–11 μ, with thick epispore at first, thinning at maturity.

Spermogonia immersed in the thallus and in the margins of the apothecia, oblately spheroidal, 80 μ tall, 160 μ in diameter, wall about 10 μ thick of very slender periclinal hyphae, hyaline below, blackened about the ostiole; spermatiophores 50 $\times$ 1 μ, once or twice dichotomous above; spermatia bacilliform, straight, 6.5 $\times$ 1 μ.

Jaeger 599 is an old thallus with a few lobes showing microphylline margins, apparently regeneration following insect? damage to the margin.

SIERRA LEONE: Loma Mts., corticole, *P. Jaeger 599*, at Kew.
NIGERIA: Nupe, on trees, *Charles Barter*, Niger Exp., at Kew.
SOUTHWEST SUDAN: Djur, Scriba Ghattas, lignicole, *Schweinfurth* at Farlow Herb.

NON-AFRICAN SPECIES

Parmelia cristifera Taylor and *P. saccatiloba* Taylor have often been misinterpreted since their publication before the use of microscopic characters, hence it seems desirable to record their characters based on the types in Taylor's herbarium, now at the Farlow Herbarium.

PARMELIA CRISTIFERA Taylor, London Jour. Bot. 6:165. 1847.

Type: India, Calcutta, *Wallich*, in Taylor Herb. at Farlow Herb.; Brazil, *Gardner*, also cited. Since this specimen is probably a later Brazilian species, the former may be taken as the type of *P. cristifera*.

Thallus at least 30 cm. in diameter, deep olive buff, surface reticulate rimose in center, less distinctly so at the margins, very coarsely and predominantly radially rugose; lobes imbricate, central lobes rounded, about 15 mm. wide and long, margins very crisped and suberect, with subspherical soralia, 0.5 mm. in diameter, mostly confluent into a continuous band, with occasional similar soralia scattered over the surface but not submarginal; underside black to the margins, or narrowly decolored and almost white below the soredia, eciliate; rhizinae not seen as the thallus is closely glued to the herbarium sheet; upper cortex 45 μ thick, fastigiate, the outer 25 μ a greenish brown layer of very thickwalled, conglutinate cells 25 $\times$ 9 μ, formed by dichotomy of erect hyphae just under the layer, the rest hyaline, slightly nubilated with grayish granules and an occasional algal cell pushing up between the cortical hyphae; algal layer 15–20 μ thick, of colonies of *Trebouxia* in a nearly continuous layer, so heavily nubilated with brownish granules that structure is not clear, cells 4–5 μ in diameter; medulla K yellow, C–, KC– (atranorine and salacinic acid, fide Hale, annotation, 1957), 100 μ thick, the upper two thirds heavily nubilated with grayish granules, of very thickwalled, longitudinal hyphae, 3 μ in diameter, very closely woven, the lower third with few granules and somewhat more loosely woven, tending to tear in this zone in sectioning; lower cortex black, 25 μ thick, of fastigiate pseudoparenchyma; marginal soredia formed by bursting of the cortex, the medullary hyphae protruding with colonies of algae spreading over their tips, forming soredia 30 μ in diameter.

Apothecia 1.5–2 mm. in diameter, probably becoming larger, margins thick, inrolled, entire to very slightly crenate, probably finally sorediose, exciple smooth,

disc ochraceous tawny to buckthorn brown; amphithecial cortex 65 μ thick, fastigiate, the outer cells 40 $\times$ 10 μ, less conglutinate than in the thalline cortex, the rest more pseudoparenchymatous; algal layer 65 μ thick, of closely packed colonies, occasionally pushing up through a break in the cortex (to form soredia?), algal layer under the parathecium 30 μ thick, continuous; parathecium 30 μ thick, of fastigiate, thickwalled pseudoparenchyma; hypothecium 15 μ thick, of slender periclinal hyphae; thecium 130 μ tall; paraphyses slender, dichotomous above the asci, tips clavate to subspherical, 4 μ in diameter, covered by a pale brownish epithecial gel; asci 70 $\times$ 30 μ, wall about 3 μ thick, tips thicker, 8-spored; ascospores ellipsoidal, 26 $\times$ 15 μ, epispore 3 μ thick; both asci and ascospores resembling those organs of the Pertusariaceae but smaller.

PARMELIA (AMPHIGYMNIA) **Gardneri** Dodge, sp. nov.

Type: Brazil, without locality,[1] *George Gardner*, in Taylor Herb. sub *P. cristifera* Tayl., at Farlow Herb.

Thallus 10 cm. diametro, obscure olivaceo-alutaceus, K dilute flavescens; lobis peripheric is imbricatis, 10–20 mm. latitudine, 25 mm. longitudine, crenatis, sinibus acutis, anguste nigromarginatis, laevibus, crispatis; lobis centralibus minoribus, irregularibus, marginibus sorediosis, crispatis, sinibus rotundatis, non nigromarginatis; soralia captitata mox confluentia; infra niger, marginibus obscure brunneis, rhizinis non visis; cortex superior 30 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis 6 μ diametro, protoplastis sphaericis, 3 μ diametro; stratum algarum 13–15 μ crassitudine, coloniis *Trebouxiae*, subcontinuum, cellulis 6 μ diametro; medulla K–, C–, KC– aut dilutissime flavescens, 90 μ crassitudine, hyphis pachydermeis longitudinalibus dense intertextis, nubilatis; cortex inferior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 3–4 μ diametro.

Apothecia 4 mm. diametro, sessilia, submarginalia, marginibus sorediosis, excipulo rugoso subscrobiculatove, disco castaneo; cortex amphithecialis 115 μ crassitudine, pseudoparenchymatice fastigiatis, hyphis 10 μ diametro, protoplastis sphaericis 2 μ diametro; stratum algarum 30 μ crassitudine, subcontinuum; stratum algarum sub parathecio 65 μ crassitudine, coloniis densis; parathecium 50 μ crassitudine, fastigiatum, hyphis 3 μ diametro; hypothecium 30 μ crassitudine, hyphis tenuibus periclinalibus; thecium 135 μ altitudine; paraphyses tenues, septatae, apicibus non incrassatis; asci clavati, 80 $\times$ 23 μ; ascosporae octonae, ellipsoideae, 16–20 $\times$ 10–12 μ, episporio 2.5 μ crassitudine.

Thallus 10 cm. in diameter, deep olive buff (1957), K pale yellow, peripheral lobes imbricate, 10–20 cm. wide, about 25 mm. long, coarsely but deeply crenate, sinuses mostly acute, rarely rounded, narrowly black margined, smooth, larger lobes crisped; central lobes smaller, more irregular, margins crisped, capitate soraliate, soralia 0.5 (–1) mm. in diameter, soon confluent into a marginal band, sinuses rounded, sometimes margins of sinuses slightly dentate, mostly smooth, not black-margined, wholly eciliate; underside of peripheral lobes black or very dark brown

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[1] Eastern tropical Brazil, probably between Ceará and Pernambuco or along the São Francisco River in western Bahía and eastern Piauhy, as Gardner's specimens from the Serra das Orgãos are usually labeled Organ Mts. in Taylor's herbarium.

to the margins, smooth to minutely rugulose, shining; margins of sorediiferous lobes warm buff or lighter, occasionally irregularly so; rhizinae not seen; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, hyphae 6 μ, protoplasts spherical 3 μ, the outer 10 μ brownish; algal layer 13–15 μ thick, a nearly continuous layer of colonies of *Trebouxia*, cells 6 μ in diameter; medulla K–, C–, KC very faint yellowish, perhaps dye diffusing from the cortex, 90 μ thick, of longitudinal thick-walled hyphae, very closely woven, heavily nubilated, looser and less nubilated in the lower 10 μ; lower cortex 20 μ thick, of fastigiate pseudoparenchyma, hyphae thickwalled, 3–4 μ in diameter.

Apothecia 4 mm. in diameter, sessile or nearly so, submarginal, margins a narrow band of granular soredia, exciple rugose to subscrobiculate, disc chestnut; amphithecial cortex 115 μ thick, of fastigiate pseudoparenchyma, hyphae 10 μ in diameter, protoplasts spherical, 2 μ in diameter; algal layer 30 μ thick, subcontinuous; medulla 350 μ thick; algal layer under the parathecium 65 μ thick, of discrete, closely packed colonies; parathecium 50 μ thick, fastigiate, hyphae conglutinate, 3 μ in diameter, protoplasts 2 μ; hypothecium 30 μ thick, of closely woven, slender, periclinal hyphae; thecium 135 μ tall; paraphyses slender, septate, tips not enlarged, ending about 7 μ below the surface of the brownish epithecial gel; asci clavate, 80 $\times$ 23 μ, moderately thickwalled, 8-spored; ascospores ellipsoidal 16–20 $\times$ 10–12 μ, epispore 2.5 μ thick.

This species differs from *P. cristifera* Taylor from India, in the larger dimensions of most parts of the apothecium, smaller ascospores and negative reaction of the medulla with K.

BRAZIL: without locality, *George Gardner*, in Taylor Herb. sub *P. cristifera* cited in the original description, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) SACCATILOBA Taylor, London Jour. Bot. 6:174. 1847.

Type: Pitcairn Island, *Beechey*, corticole, in Taylor Herb., at Farlow Herb.

Thallus 14 cm. or more in diameter, center pinkish buff, some peripheral lobes olive buff (1957), lobes rounded up to 25 mm. wide, 20 mm. long, very convex, margins coarsely crisped, from slightly dentate to short isidiose and lobulate, lobules up to 1.3 mm. long, cuneate, 0.3 mm. wide at the base, 0.8 mm. at the truncate apex; surface smooth, reticulate rimose in the older portions with patches of moderately dense to very dense short coralloid isidia, appearing granular under low magnifications; underside wholly black to the margins of central lobes, shading to cinnamon buff on some peripheral lobes; rhizinae not seen as thallus is glued to the herbarium sheet; upper cortex 30 μ thick, fastigiate, hyphae arising from the medulla twice closely dichotomous above the algae, the branches soon parallel, 6 μ in diameter, the upper 10 μ nubilated with yellowish green granules, cells nearly isodiametric, conglutinate; algal layer 15 μ thick, cells in rows between vertical medullary hyphae, spherical, 6 μ in diameter, not filamentous; medulla K–, C–, KC–, 200 μ thick, of very closely woven longitudinal hyphae, 6 μ in diameter, very heavily nubilated with grayish granules, tearing very easily about 15 μ from the lower cortex; lower cortex black, 15–25 μ thick, apparently pseudoparenchymatous from longitudinal hyphae, but so carbonaceous that I have been unable to cut sections thin enough to see clearly.

Apothecia up to 6 mm. in diameter, substipitate, margin and upper part of the exciple granular isidiose, exciple otherwise smooth, disc chestnut; amphithecial cortex 25 μ thick, fastigiate as in the thalline cortex; algal layer 15 μ thick, continuous; medulla very closely woven, very heavily nubilated next the algal layers; algal layer under the parthecium 40 μ thick, of closely packed colonies of *Trebouxia*, subcontinuous; parathecium 35 μ thick, the lower half of very thickwalled periclinal pseudoparenchyma, lumina 1 μ in diameter, the upper half similar with larger lumina, about 2 μ in diameter and more deeply staining; hypothecium 20 μ thick, of very slender more loosely woven periclinal hyphae with longer cells, not deeply staining; thecium 140 μ tall; paraphyses slender, septate, once or twice dichotomous near the clavate tips, 3 μ in diameter, ending about 7 μ below the surface of the pale brownish epithecial gel; asci clavate, 80 $\times$ 28 μ, 8-spored, wall about 4 μ thick, tips thicker; ascospores ellipsoidal, 20–23 $\times$ 13 μ, epispore 2.5–3 μ thick.

PSEUDEVERNIA

PSEUDEVERNIA Zopf, Beitr. Bot. Centralbl. 14:124. 1903.

Parmelia sect. *Everniiformes* Hue, Nouv. Arch. Mus. [Paris] IV. 1:135. 1899.
Parmelia subg. *Euparmelia* sect. *Everniaeformes* Zahlbr. in Engler & Prantl, Nat. Pflanzenfam. I. 1*:212. 1907.

Type: ***Parmelia furfuracea*** (L.) Ach.

Thallus polyphyllous, usually medium to large, but rather small in some of our African species, erect to decumbent or pendent, mostly attached at or near the bases of the lobes, lobes linear to lanceolate, dichotomous, margins often sparsely ciliate, cilia occasionally making contact with a substrate and functioning as rhizinae; underside usually dark, sometimes shading to light colored at the tips of the lobes, rarely wholly light colored below, rhizinae dense to sparse or absent, usually not functional; upper cortex of fastigiate pseudoparenchyma, algae *Trebouxia*; medulla of closely woven but not conglutinate longitudinal hyphae, sometimes more loosely so just under the algal layer; lower cortex pseudoparenchymatous from longitudinal hyphae, rarely of fastigiate pseudoparenchyma. Apothecia not common, relatively large, substipitate.

Pseudevernia is closely related to *Everniopsis*, but lacks the conglutinate hyphae of the medulla forming a sclerotic ribbon and is less rigid when dry. The erect to decumbent species of *Omphalodium* are very rigid when dry, almost woody. *Pseudevernia* is rare or seldom collected in tropical Africa, being much more common with many more species in tropical America.

1. Thallus isidiose, small, lobes 1–1.5 mm. wide; habit of *Parmelia caraccensis*, presumably densely rhizinose below; Mauritius ..... *P. mauritiana* (Gyelnik) Dodge
1. Thallus sorediose; medulla K–, C– 2
1. Thallus neither isidiose nor sorediose 3
   2. Margins and adjacent upper surfaces soraliate, dirty yellow, lobes up to 25 $\times$ 1.5–5 mm.; underside black reticulate, nude or with rare rhizinae; Cameroons ..... *P. kamerunensis* (Steiner) Dodge
   2. Soralia small, confluent on upper surface, pale dirty green, linear multifid, canaliculate below at the tips, with a few rhizinae; lobes pinnatifid, tips digitate palmate; Cape of Good Hope ..... *P. molliuscula* (Ach.) Dodge
   2. Saxicole; nomen nudem ..... *P. molliuscula* v. *kilimanjaroensis* Stein

3. Thallus pale yellow or yellowish green, 12–13 mm. tall, terete or compressed, lobes 2–4 mm. wide, tips multifid; underside pale brown, sparsely rhizinose; medulla K yellow then orange red; Cape of Good Hope.....*P. thamnidiella* (Stirton) Dodge
3. Thallus ashy to pale green, lobes flattened.....4
4. Epiphyllous; poorly described; Tanganyika..*Parmelia kamptschadalis* v. *epiphylla* Cengia Sambo
4. Corticole; apothecia subpedicellate, disc subtestaceous; lobes narrow, canaliculate; underside black, without rhizinae; medulla K pale yellow rufescent, C–, KC pale yellowish; Cape of Good Hope to Angola.....*P. polita* (Fr.) Dodge

The following species of *Pseudevernia*, of which I have seen no specimens, have been described from Africa.

PSEUDEVERNIA **mauritiana** (Gyelnik) Dodge, comb. nov.

Parmelia caraccensis f. *isidiosa* Müll. Arg., Flora 74:375. 1891.
Parmelia mauritiana Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] 29:288/416. 1931.

Type: Mauritius, without collector, at Kew.

PSEUDEVERNIA **thamnidiella** (Stirton) Dodge, comb. nov.

Parmelia thamnidiella Stirton, Trans. Glasgow Soc. Field Nat. 5:213. 1877.
Parmelia conspersa v. *thamnidiella* Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888/9: 153. 1890.

Type: Cape of Good Hope, Somerset East, terricole, *P. MacOwan.*

PSEUDEVERNIA **kamerunensis** (Steiner) Dodge, comb. nov.

Parmelia Kamerunensis Steiner, Verhandl. Zool. Bot. Ges. Wien 53:232. 1903.

Type: Cameroons, Fako, 3600–3800 m., *Alfred Bornmüller.*

Thallus erect in pulvinate tufts, 3 cm. tall, upper surface cream buff, very narrowly black margined with scattered marginal cilia up to 2 mm. long, closely thrice dichotomous in the middle, a few making contact with a solid surface, forming a small black disc holdfast from which radiate 4 short branches; underside black shading to much lighter tips, almost cream buff, transversely reticulate rugose; soralia at first marginal, forming at the junction of the upper and lower cortices, with slightly elevated margins, spreading over the upper surface, about 0.2 mm. in diameter, then new ones burst the upper cortex and become confluent until the upper cortex has been eroded and disappears, soredia about 30 μ in diameter; upper cortex 16 μ thick, of fastigiate pseudoparenchyma, cells 3.5 μ in diameter, protoplasts about 1 μ; algal layer 20 μ thick, of subcontinuous colonies of *Trebouxia*; medulla K–, C–, KC yellowish, 90 μ thick, of closely woven longitudinal hyphae 3.5 μ in diameter, lumina 1.5 μ, somewhat more loosely woven next the algal layer; lower cortex 13 μ thick, outer surface dark brown, very highly gelified, of about 3 layers of somewhat interwoven longitudinal hyphae, protoplasts spherical, 1 μ in diameter. Apothecia not seen.

Spermogonia rare, black, very slightly emergent, not sectioned owing to scanty material available.

ETHIOPIA: Chokke Mts., ca. 10° 40′ N., 37° 45′ E., north of Debra Marcos, below Talo, 4030 m., epiphyte on *Erica*, *R. G. Hiller L86*, C.B.E.E., at Kew.

UGANDA: Bugishu, Bulabuli, 2900 m., in bamboo forest, *A. S. Thomas 549* p. p. min., at Kew.

TANGANYIKA: Kilimanjaro, 2900–3025 m., on giant heather in clearings (former fires) in rain forest, *R. G. Turrall 55* p. p. min., juvenile, at Kew.

PSEUDEVERNIA **molliuscula** (Ach.) Dodge, comb. nov.

Parmelia molliuscula Ach., Lichenogr. Univ. 492. 1810.
Parmelia conspersa f. *molliuscula* Vainio, Termeszetr. Füzetek 22:280. 1899.

Type: Cape of Good Hope, *Thunberg.*

Thallus 5 cm. or more tall, pale virescent (now 1957 cinnamon) K–, C bleached to white, probably suberect to decumbent (Acharius states "substellata . . . vix stellatus"), lobes more or less linear from a common holdfast, up to 5 mm. broad below, irregularly dichotomous, subpinnate on the sides and palmate digitate above, narrowing at each dichotomy, ultimate lobules 2–3 mm. long, 1–1.5 mm. wide, tips rounded or obtuse, convex below becoming canaliculate at the lobules and smaller branches, quite fragile when dry; underside snuff brown to Saccardo's umber, smooth to minutely reticulate rugulose, nearly nude; rhizinae few, rarely submarginal, usually near the center of the lobe, solitary, rather stout, about 1 mm. long, concolorous; upper cortex 30 μ thick, upper half gelified, heavily nubilated with pale brownish granules, lower half of thinner-walled pseudoparenchyma, cells 4–5 μ in diameter, somewhat irregularly arranged; algal layer 25–30 μ thick, of close, discrete colonies of *Trebouxia,* heavily nubilated with grayish granules, cells 5–6 μ in diameter; medulla K–, C–, KC–, 200 μ thick, of moderately closely woven, dichotomous, thickwalled hyphae, irregularly arranged but predominantly longitudinal, 5–6 μ in diameter, heavily but irregularly nubilated by pale brownish granules; lower cortex 15 μ thick, pale, of fastigiate pseudoparenchyma, lumina about 1 μ in diameter, somewhat irregularly arranged. Apothecia unknown.

CAPE OF GOOD HOPE: *Zeyher,* ex Kunze herb. sub *Evernia*? det. *P. molliuscula* by Tuckerman, in Tuckerman Herb. at Farlow Herb.

PSEUDEVERNIA **polita** (Fr.) Dodge, comb. nov.

Parmelia polita Fr., Syst. Orb. Veg. 283. 1825.

Type: Cape of Good Hope.

Thallus erect, over 3 cm. tall, pale olive buff, convex above, surface white reticulate and somewhat minutely rimulose, branching unequally dichotomous, eciliate, lobes about 2 mm. wide at the moribund base, narrower at each dichotomy; underside canaliculate, black, reticulate rugose with scattered slender rhizinae about 0.5 mm. long, somewhat closer and coarser with dichotomous tips near the apices of the lobes; upper cortex 15–20 μ thick, of fastigiate pseudoparenchyma, the outer half densely nubilated with minute brownish granules; algal layer of discrete colonies of *Trebouxia,* 20–25 μ in diameter, subcontinuous, cells 6–7 μ in diameter; medulla K pale yellow rufescent, C–, KC pale yellowish, 50 μ thick, of very closely woven longitudinal hyphae with occasional transverse strands, hyphae thickwalled, 3–4 μ in diameter; lower cortex black, 6–7 μ thick, of conglutinate, longitudinal hyphae, closely septate with moderately thick walls, 3.5 μ in diameter.

Apothecia superficial, 6 mm. in diameter, pedicel 2 mm. tall, 1.8 mm. in diameter, margins inrolled when dry, exciple smooth, disc brick red, apparently dying or more probably eaten by insects and the parathecium regenerating as cortex in the center; not sectioned as only one apothecium present in our material.

Fries' very brief description agrees with our material, but I have not seen the type nor an amplified description based on the type.

ANGOLA: Cuanza Sul, Amboim, Capir near the Carloaongo-Cuvo River, 1000 m., on dead trees, *J. Gossweiler 9991, 9993* p. p. min., at Kew.

CAPE OF GOOD HOPE: Saldanha Bay, without collector, herb. Hookerianum, growing with *Omphalodium hypoleium* (Nyl.) Dodge, at Kew.

EVERNIOPSIS

EVERNIOPSIS Nyl., Syn. Meth. Lich. 1:374. 1860.

Parmelia sect. *Everniopsis* Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1862:174. 1862.
Hendrickxia Duvigneaud, Bull. Jard. Bot. Etat Bruxelles 16:357. 1942.

Type: *Parmelia trulla* Ach. The type of *Hendrickxia* is *H. pseudoreticulata* Duvigneaud.

Thallus erect or pendent, not rigid, 7.5–12.5 cm. long, flat or canaliculate above, 4 mm. or less wide below, dichotomously branched, eciliate, light colored below, smooth without rhizinae; morphologic upper cortex of fastigiate thickwalled pseudoparenchyma; algal layer continuous, cells closely packed, probably *Trebouxia*; medulla completely sclerotic, of conglutinate thickwalled hyphae, fraying out into loosely woven hyphae of the medulla of the apothecia; morphologic lower cortex of conglutinate longitudinal hyphae similar to the medulla but the hyphae are larger with smaller lumina.

Apothecia submarginal, substipitate, relatively large, exciple longitudinally rugose, disc remaining concave, imperforate, chestnut or darker; parathecium of conglutinate, very thickwalled periclinal hyphae; asci 4–8-spored, rather thickwalled, tips not thicker; ascospores ellipsoid, 11–16 × 7–10 μ with a thick epispore, protoplasts roughened as in the Pannariaceae. Spermogonia of the type usually found in the Parmeliaceae.

E. pseudoreticulata is epiphytic in subalpine areas in Congo and Uganda. The only other species known, *E. trulla* (Ach.) Nyl., extends from Mexico to northern Chile at high elevations.

In *Everniopsis*, the whole medulla is sclerotic and the structure is dorsiventral, while in the Usneaceae, the structure is radial, with a medulla differentiated from the central sclerotic strand. In all its characters it clearly belongs in the Parmeliaceae rather than in the Usneaceae where it was placed by Zahlbruckner.

EVERNIOPSIS **pseudoreticulata** (Duvign.) Dodge, comb. nov.

Hendrickxia pseudoreticulata Duvign. Bull. Jard. Bot. Etat Bruxelles 16:359. 1942.

Type: Congo, Mt. Kahusi, 3° S., 3300 m., *F. L. Hendrickx.*

Thallus probably pendent, about 10 cm. long, dichotomously branched, lower internodes about 10 mm. long, the upper somewhat shorter, tips retuse, lobes 2–3 mm. wide below, about 1 mm. above, olive buff, opaque, canaliculate, below Isabella color, somewhat shining, without rhizinae or cilia; upper cortex 16 μ thick, fastigiate, cells very thickwalled, 8 μ in diameter, protoplasts about 3 μ; algal layer 30–35 μ thick, of closely packed cells 6–7 μ in diameter; medulla 80–100 μ thick, of conglutinate, interwoven hyphae, 6–7 μ in diameter; lower cortex about 25 μ

thick, of longitudinal conglutinate hyphae 8–9 μ in diameter, lumen about 1 μ.

Fertile portion at dichotomy widened to 5 mm., somewhat rugose, cortex rimose; apothecia subpedicellate, marginal on the upper surface, 2 mm. in diameter, deeply cupulate, exciple longitudinally rugose, disc very concave, chestnut; amphithecial cortex 30–35 μ thick, of the same structure as the thalline cortex; outer medulla 80–100 μ thick, very loosely woven, of thickwalled hyphae, with single algal cells in the meshes, inner medulla next the hypothecium 30 μ thick, of predominantly periclinal, conglutinate thickwalled hyphae (easily cracking away from the outer medulla on sectioning); hypothecium 20–25 μ thick, of very slender interwoven but mostly periclinal hyphae; thecium 65–70 μ tall; paraphyses slender, conglutinate, lumen about 1 μ in diameter, several times dichotomously branched above the asci; asci subcylindric, 75–80 $\times$ 15 μ, wall 2–3 μ thick, tip not thickened, 4-spored; ascospores ellipsoid, hyaline, unicellular, 16 $\times$ 10 μ, wall rather thick, outer surface of the protoplast slightly rough, suggesting the ascospores of the Pannariaceae.

Spermogonia semiemersed, marginal on the older portions of the thallus below the fertile areas, 115 μ tall, 80 μ in diameter, wall blackened in the upper half, nearly hyaline below, about 8 μ thick, of slender periclinal hyphae; spermatiophores 16 $\times$ 1.5 μ, septate; spermatia bifusiform, 6.5 $\times$ 1 μ.

CONGO: Luha, road to Kahusi, epiphyte, *F. L. Hendrickx 4247*, fertile; Kahusi, *F. L. Hendrickx 4253*, sterile; Kahusi, chute de la Luha, *F. L. Hendrickx 4248*, fragment; all in E. African Herb.

UGANDA: Kigezi, Naiguru, 2255 m., in impenetrable forest, *I. R. Dale L62*, fertile, at Kew.

OMPHALODIUM

OMPHALODIUM Mey. & Fw., Nova Acta Acad. Leopold-Carol. **19**: Suppl. 1:223. 1843; Fw., Linnaea **17**:27. 1843.

Parmelia subg. *Omphalodium* Nyl. in Hue, Nouv. Arch. Mus. [Paris] III. **2**:291. 1890.

Type: O. *pisacomense* Mey. & Fw.

Thallus monophyllous or polyphyllous, rigid, attached by a central or somewhat excentric gomphus as in the Umbilicariaceae, upper surface white reticulate, cortical cells under the white areas not conglutinate; cortices of fastigiate pseudoparenchyma; algae *Trebouxia* (*Trentepohlia* in O. *convolutum*); medulla C–, K and KC– or orange red in a thin zone just under the algal layer.

Apothecia up to 20 mm. in diameter, mostly smaller, sessile to stipitate; amphithecium present; parathecium of fastigiate pseudoparenchyma (fastigiate below, periclinal above in O. *hypoleium* and wholly periclinal in O. *mazoensis*); ascospores small to medium in size, hyaline, ellipsoid, unicellular.

There has never been agreement among lichenologists whether this genus should be included in the Umbilicariaceae or the Parmeliaceae. The thallus closely resembles the Umbilicariaceae in many characters while the apothecia and ascospores are like those of the Parmeliaceae.

1. Thallus monophyllous, margin deeply lobed....2
1. Thallus polyphyllous....3
2. Margins ciliate, surface ashy green, underside black, rhizinose....*O. stictellum* (Mass.) Dodge
2. Margins not ciliate, surface chestnut brown; underside darker brown, erhizinose....*O. umbilicatum* (Del.) Dodge
3. Underside nude or with very few scattered rhizinae....4
3. Underside rhizinose, at least on the distal portions of the lobes....6
4. Margins ciliate: algae *Trentepohlia*; lobes inrolled forming a ball, which early breaks away from the gomphus....*O. convolutum* Hue
4. Margins eciliate....5
5. Lobes flabellate, di- to poly-chotomous, more than 2 mm. wide, mostly wider; underside brown; medulla K yellow then red next the algal layer....*O. phalacrum* (Hue) Dodge
5. Lobes linear, closely dichotomous, 1–1.5 mm. wide; underside black with an occasional rhizina; medulla K–....*O. hypoleium* (Nyl.) Dodge
6. Rhizinae confined to distal portions of lobes....7
6. Rhizinae covering the whole underside....8
7. Lobes cuneate, apothecial margins ciliate; upper cortex of thinwalled pseudoparenchyma....*O. ceranoides* (Lam.) Dodge
7. Lobes rounded, apothecial margin eciliate, exciple rugose scrobiculate; upper cortex of thickwalled pseudoparenchyma....*O. pachythallum* (Sprgl.) Dodge
8. Primary lobes cuneate, 10 mm. wide, ultimate lobules narrow, 10 mm. long; exciple ciliate; parathecium of fastigiate pseudoparenchyma; ascospores 10 × 5 μ....*O hottentottum* (Thunb.) Fw.
8. Primary lobes rounded, 10 mm. long, 5 mm. wide; margin very sparsely ciliate; exciple eciliate, scrobiculate; parathecium of periclinal pseudoparenchyma; ascospores 12–13 × 6–7 μ....*O. mazoense* Dodge

Omphalodium **stictellum** (Mass.) Dodge, comb. nov.

Parmelia stictella Mass., Mem. Ist. Veneto Sci. Lett. Arti. **10**:52. 1861.

Type: Cape of Good Hope, *Heinrich Wawra.*

Thallus monophyllous, rigid, 5–9 cm. in diameter, deep lichen green or darker, some ultimate lobes discolored pinkish cinnamon, center continuous, peripheral lobes 10 mm. long, 8–10 mm. wide, rounded, sinuses rounded to excised; margins very closely ciliate, cilia 0.8 mm. long, coarse, tips obtuse; surface closely white reticulate, smooth; gomphus 5 mm. in diameter, of densely interlaced fibers; underside sayal brown or darker, nude, deeply reticulate rugulose in the center, shading to black, densely rhizinose on the peripheral lobes, rhizinae 1–1.5 mm. long, tips acute; upper cortex 40–50 μ thick, of fastigiate pseudoparenchyma, cells about 4 μ in diameter with moderately thick walls, very heavily nubilated with brownish granules in the outer 30 μ, interrupted by non-conglutinated cells and non-nubilated areas (the white lines of the upper surface; algal layer 30 μ thick, continuous with occasionally close, discrete colonies of *Trebouxia*, cells 7–8 μ in diameter; medulla K and KC orange next the algal layer, the rest negative, C–, 135 μ thick, of closely woven, longitudinal, thickwalled hyphae, 3–4 μ in diameter, heavily nubilated with grayish granules in the upper 40 μ; lower cortex black, 15 μ thick, of a single layer of pyriform, thickwalled cells, very closely packed, 15 × 5–6 μ; rhizinae 140 μ in diameter, formed by the outgrowth of the medullary hyphae, corticate by cells from the lower cortex.

Apothecia superficial and submarginal, sessile, up to 5 mm. in diameter, margin entire, inrolled when dry, ciliate, cilia 0.5 mm. long, blunt; exciple smooth lichen green, stained orange in places; disc concave, finally nearly plane, auburn or darker; amphithecial cortex 15 μ thick, fastigiate, gelified, lumina 1 μ in diameter; algal layer of very scattered cells and very small colonies; medulla thick, nubilated above with grayish granules; algal layer under the parathecium 55 μ thick, nearly continuous with occasional cells pushing up between the parathecial hyphae; para-

thecium 40 μ thick, of fastigiate pseudoparenchyma, protoplasts 1 μ in diameter, deeply staining in the upper 15 μ; hypothecium 15 μ thick, of slender, periclinal hyphae, closely interwoven, deeply staining; thecium 55 μ tall; paraphyses slender, several times dichotomous above the asci, tips pyriform, 3 μ in diameter, reaching the surface of the brownish epithecial gel; asci clavate, 40 $\times$ 8 μ, tips thickened, protoplast long mammillate when young; ascospores broadly ellipsoid, 8 $\times$ 5 μ with a moderately thick epispore.

Burchell's collection has somewhat narrower peripheral lobes and a somewhat excentric gomphus.

CAPE OF GOOD HOPE: without definite locality, *W. J. Burchell* ex herb. W. A. Leighton; District Clanwilliam, top of Packhuis Pass, saxicole; O. *Almborn*, Lich. Africani 17, both in Dodge Herb.

OMPHALODIUM CONVOLUTUM Hue, Nouv. Arch. Mus. [Paris] IV. 2:111. 1900.

Parmelia convoluta Zahlbr., Cat. Lich. Univ. 6:272. 1929 non Krmph.
Parmelia Hueana Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] 29:288/416. 1931.

Type: South West Africa, Walvis Bay, *Duparquet*, on sand.

Thallus 6 cm. or more in diameter, buffy brown, white punctate to reticulate; no trace of gomphus which has broken off and healed over, base 1 mm. wide rapidly expanding to a cuneate lobe 7 mm. wide, giving rise to 7 secondary lobes 1–3 mm. wide, irregularly dichotomous to subpinnate, again branched or lobulate, margin with close cilia 3–4 mm. long, broad at the base, tapering to an acute tip; lobes inrolled when dry, forming a black ball; surface smooth; underside black, longitudinally rugose with a few punctate ecorticate areas (similar to pseudocyphellae but medullary hyphae not protruding); upper cortex very variable in thickness, 65–100 μ thick, the outer layer 20 μ thick, of fastigiate pseudoparenchyma, hyphae 3 μ in diameter with moderately thick walls, heavily nubilated with brownish granules, almost obscuring structure, a middle layer 15–20 μ thick gelified, of longitudinal hyphae, lumina 1 μ thick or less, and an inner layer, fastigiate, 20–55 μ thick, hyphae dichotomous, 6–7 μ in diameter, sparingly septate; with apotheciiform thickenings 800 μ wide, where the outer layer becomes 25 μ, the middle layer 65 μ and the inner layer 115 μ thick, with columns of algae varying in width pushing up through the lower layer; algae *Trentepohlia* in a zone 30–65 μ thick, of more or less longitudinal filaments 6–7 μ in diameter, septate into nearly isodiametric cells, separated in places by strands of medullary hyphae which form the lower layer of the cortex, the algal filaments giving rise to vertical branches to form the columns of algal filaments which may reach the surface in cracks between the normal cortex and the apotheciiform enlargements, no terminal zoosporangia certainly seen, although a few terminal cells become spherical, 10 μ in diameter; medulla K–, C–, KC–, 165 μ thick, of interlaced strands of dichotomous hyphae 6–7 μ in diameter, sparsely septate, lumina about 2 μ in diameter, heavily nubilated with grayish brown granules for a variable distance below the algal layer, irregularly distributed, with cavities 50 μ in diameter to within 40 μ of the lower cortex, partly filled with algal filaments projecting from the walls; lower cortex 7–15 μ thick, black, of interlaced hyphae 3–4 μ in diameter, septate into cells varying from 4–8 μ long, with thick brown walls. Apothecia and spermogonia not seen.

Our specimens are somewhat smaller than the type, but agree otherwise.

CAPE OF GOOD HOPE: without locality, *C. F. Ecklon*, ex herb. Sbarbaro sub *Parmelia pachythalla* at Farlow Herb.

OMPHALODIUM **phalacrum** (Hue) Dodge, comb. nov.

Omphalodium hottentottum v. *phalacrum* Hue, Nouv. Arch. Mus. [Paris] IV. 2:210. 1900.

Type: Cape of Good Hope, Groenkloof, *Breutel* sub *Parmelia reticulatum* Nees von Esenbeck, cotype, at Farlow Herb.

Thallus polyphyllous, holdfast 15 mm. in diameter, composed of coarse, interlaced rooting fibers penetrating the soil; upper surface rough, black, giving rise to many erect or decumbent lobes about 30 mm. long, stipes flattened, about 5 mm. tall, then closely dichotomous to polychotomous producing strapshaped to subflabellate lobes 10–15 mm. long, 2–5 mm. wide, margins smooth, revolute, tips rounded to truncate, upper surface avellaneous to vinaceous buff, minutely white reticulate; underside Natal brown to bone brown, smooth or slightly longitudinally rugulose, nude on the lobes, two rhizinae seen on the stipes, 1 and 3 mm. long, tip branched, branches enclosing grains of sand in one case; upper cortex 30 μ thick, but sometimes extending to 140 μ between algal colonies to make contact with the medulla, of fastigiate pseudoparenchyma, cells 3 μ in diameter, slightly nubilated; algal layer rather variable in thickness, mostly about 55 μ thick, of discrete colonies in a nearly continuous layer, cells 8 μ in diameter, with some colonies pushing up columns of algal cells nearly to the outer surface of the cortex, then simulating *Trentepohlia* with nearly isodiametric cells, and an occasional algal cell lower in the medulla; medulla K slowly yellow then reddish, C–, KC–, 185–200 μ thick, of densely woven thickwalled hyphae 3 μ in diameter; lower cortex 50 μ thick, of fastigiate pseudoparenchyma, the outer 15 μ brownish and heavily nubilated, the rest hyaline and the hyphae less closely septate.

Apothecia immature, 3–5 mm. in diameter, margin inrolled, becoming crenulate, exciple smooth, disc rufous; amphithecial cortex 30 μ thick, of fastigiate pseudoparenchyma, heavily nubilated; algal layer 100 μ thick, of discrete, conical colonies with the apex toward the cortex, about 80–135 μ in diameter at the base, separated by vertical medullary hyphae; medulla rather closely woven; algal layer under the parathecium 25–30 μ thick, undulating, cells closely packed above, less so beneath; parthecium 65–95 μ thick, fastigiate, more closely septate and deeply staining above; hypothecium 55 μ thick, of very slender densely woven, deeply staining periclinal hyphae; thecium 40 μ tall; paraphyses coarse, closely septate, ending about 12 μ below the surface of the brownish epithecial gel, dichotomous at the level of the upper part of the asci, tips not enlarged; asci broadly clavate, 25–30 $\times$ 10–13 μ, wall and tips thickened; ascospores ellipsoid, 8 $\times$ 5 μ, only seen in the asci.

As the apothecia are still immature, the dimensions of the thecium, asci and ascospores may be too small.

CAPE OF GOOD HOPE: Groenkloof, *Breutel*, sub *Parmelia reticulatum* Nees von Esenbeck, cotype, at Farlow Herb.

OMPHALODIUM **hypoleium** (Nyl.) Dodge, comb. nov.

Parmelia hypoleia Nyl., Syn. Meth. Lich. 1:393. 1860.

Type: Cape of Good Hope, probably saxicole, collector unknown, com. Kunze P. C. 314 sub *Parmelia reticulata* Nees teste Hampe, portion sent to Nylander, rest in Tuckerman Herb. sheet *777*, at Farlow Herb.

Thallus 4 cm. in diameter, bone white fide Nyl., buffy brown (1957), lobes 20 mm. or more long, 1–1.5 mm. wide, closely dichotomous, less so above, ultimate lobes up to 2.5 mm. long, 0.5 mm. wide, tips rounded; surface smooth, minutely rimulose, white reticulate to punctate but not pseudocyphellate, very narrowly black margined, deeply transversely cracked below, usually at the axils, axils rounded not excised; eciliate; underside black, opaque, irregularly rugose, slightly verrucose toward the center, an occasional verruca growing out as a stout rhizina, 1 mm. long, forked at an acute angle near the tip; upper cortex 35 (–50) μ thick, fastigiate, gelified, with some brownish granules in the upper 10 μ with areas about 35 μ wide where the hyphae are less dense and not conglutinate, hyphae very thickwalled, lumina scarcely visible, (corresponding to the white areas on the surface); algal layer 25 μ thick, nearly continuous, of colonies of *Trebouxia*, cells 6–7 μ in diameter; medulla K–, C–, KC–, 150 μ thick, of very closely woven predominantly longitudinal, very heavily nubilated with grayish brown crystals, very loosely woven in the lower 10 μ without crystals and easily tearing away from the lower cortex on sectioning; lower cortex 15 μ thick, black, of fastigiate pseudoparenchyma, cells 6 $\times$ 4 μ in diameter extending up the sides and progressively paler as it joins the upper cortex, forming pores 6–10 μ in diameter for aeration.

Apothecia 6–7 mm. in diameter, very abundant and distorted by mutual pressure; margine entire at first, upper part of exciple soon vertically sulcate and margin deeply crenate, almost lobulate, exciple otherwise smooth and slightly white-reticulate but less conspicuously so than the thallus, disc burnt sienna when young, becoming chestnut or darker in age; amphithecial cortex 50 μ thick, of the same structure as the thalline cortex but the hyphae 6–7 μ in diameter, nubilated in the outer 15 μ; algal layer 30–50 μ thick, but with many lacunae where colonies have disappeared; algal layer under the parathecium 50 μ thick, nearly continuous; parathecium 60 μ thick, the lower 25 μ of thickwalled fastigiate pseudoparenchyma, the rest of conglutinate thickwalled periclinal hyphae, lumina 4 $\times$ 2 μ, the outermost 10 μ hyaline (protoplasts scarcely staining) and not conglutinate; hypothecium 7–10 μ thick, of slender periclinal thinwalled hyphae; thecium 60–65 μ tall; paraphyses slender, septate, about once dichotomous above the asci, tips narrowly clavate ending in the brownish epithecial gel; asci 30 $\times$ 10 μ clavate cylindric, wall and tips thick when young; ascospores ellipsoidal, 10–12 (–14) $\times$ 6–7 (–8) μ, with a rather thin epispore.

Zeyher 22 has broader lobes, 2 mm. wide with ultimate lobes shorter and somewhat broader; microscopically it agrees in the structure of the thallus and apothecia.

CAPE OF GOOD HOPE: saxicole, "dedit Kunze, P. C. 314 sub *P. reticulata* Nees teste Hampe," portion of type collection in Tuckerman Herb.; Uitenhage, *Zeyher 22* sub *P. mutabilis* Taylor (not type) in Taylor Herb.; both at Farlow Herb.

var. tenuifidum (Nyl.) Dodge, comb. nov.

Parmelia hypoleia v. *tenuifida* Nyl. Syn. Meth. Lich. 1:393. 1860.

Type: Cape of Good Hope, ex Carroll Herb.

Differing from the species in narrower lobes, about 1 mm. wide at the base and ultimate lobules 0.25 mm. wide, more convex, very imbricate and suberect; cortex in older portions rimose-areolate, white punctate and reticulate above.

CAPE OF GOOD HOPE: saxicole, *Zeyher 66* on sheet with *P. mutabilis* Tayl., not type, in Taylor Herb. at Farlow Herb.; without locality, *Carl Ecklon*; Soldanha Bay without collector, herb. Hookerianum; both at Kew.

OMPHALODIUM **ceranoides** (Lam.) Dodge, comb. nov.

Lichen ceranoides Lam., Encyclop. Meth. Bot. 3:487. 1789.
Peltigera ceranoides Sprengel, Syst. Veg. 4:1:304. 1827.

Type: Cape of Good Hope.

Thallus 8 cm. in diameter, very rigid when dry, between pale pinkish buff and pale olive buff; holdfast 10 mm. in diameter, of intricately branched rootlets; polyphyllous, lower rank of lobes about 5 mm. broad, cuneate, some lobes unbranched for 15 mm., 20 mm. wide above, others split to within 5 mm. of the holdfast; lateral lobes 3 mm. wide at the base, 15 mm. long, rounded above, margin densely ciliate; upper whorl similar but lobes only 2 mm. wide at the base, more rounded, 20 mm. wide and long; peripheral lobes more variable, some rounded like primary lobes, about 10 mm. wide, others more oblong, 15–20 mm. long, 5–7 mm. wide, all closely ciliate, cilia 1–2 mm. long; surface smooth white reticulate; underside reticulate rugose, ridges predominantly longitudinal, i.e. radial, center nude, auburn or darker, secondary lobes black, densely rhizinose, rhizinae 1 mm. long; upper cortex 15 μ thick, of fastigiate thinwalled pseudoparenchyma, cells 3 μ in diameter heavily nubilated with brownish granules; algal layer 50 μ thick, continuous, of single cells and small colonies of *Trebouxia*, cells 7–10 μ in diameter; medulla K–, C–, KC–, 200 μ thick, of moderately closely woven longitudinal hyphae 4–5 μ in diameter, with occasional oblique or transverse hyphae, not nubilated; lower cortex 15 μ thick, of fastigiate thickwalled pseudoparenchyma, hyaline, outermost cells blackened; rhizinae 30–80 μ in diameter, formed of medullary hyphae, corticate by a single layer of cells from the lower cortex.

Apothecia short stipitate, deeply urceolate, margin densely ciliate, inrolled, 1.5 mm. in diameter, immature, not sectioned.

CAPE OF GOOD HOPE: Table Mt., rupicole, *Breutel*, sub *P. hottentotta* ex herb. Sbarbaro, at Farlow Herb.

OMPHALODIUM **pachythallum** (Sprengel) Dodge, comb. nov.

Parmelia pachythalla Sprengel in Nyl., Syn. Meth. Lich. 1:399. 1860.
Parmelia hottentotta v. *parchythalla* Nyl., Syn. Meth. Lich. 1:399. 1860; in Hue, Nouv. Arch. Mus. [Paris] III. 2:292. 1890.

Type: Cape of Good Hope, *Drège 73*.

Thallus at least 8 cm. in diameter, holdfast not seen as thallus glued to herbarium sheet, slate gray toward the margins, K deep red brown, black in the center, margins densely ciliate, cilia 1–2 mm. long from a broad base tapering to the acute apex, rounded lobulate, 5–10 mm. wide and long, varying from smooth to crenate or lacerate lobulate, surface smooth, minutely white reticulate, opaque, with an occasional short cilium; underside black, reticulate rugose with moderately dense rhizinae on the marginal lobes, raw umber in the center, reticulate rugose, nude; upper cortex 15 μ thick, fastigiate, hyphae 6–7 μ in diameter, lumina 1.5 μ, not pseudoparenchymatous, ends of outermost cells rounded and blackened, somewhat nubilated with dark brown granules, covered by an amorphous layer 3–6 μ thick; algal layer 30–50 μ thick, cells mostly solitary, 10 μ in diameter, sometimes in small groups among loosely woven medullary hyphae encrusted with hyaline granules; medulla K–, C–, KC–, 160–200 μ thick, of loosely woven, predominantly longitudinal hyphae, 7 μ in diameter, lumina about 2 μ, encrusted with hyaline granules; lower cortex 15–25 μ thick gelified, fastigiate, hyphae 7 μ in diameter, ends of outer cells rounded and brownish, some areas not gelified, hyphae not closely packed, septate, protoplasts about 6 $\times$ 3 μ, brownish, surrounded by the hyaline hyphal wall 3 μ thick, the ends of vertical dichotomous medullary hyphae with large air spaces, a sort of pseudocyphella.

Apothecia 6–10 (–15) mm. in diameter, urceolate at first with inrolled, ciliate margins, becoming plane, margin entire, or coarsely crenate, sometimes cracking into lobes, exciple rugose scrobiculate, warm buff, disc auburn, blackening, imperforate; amphithecial cortex 30–35 μ thick, of fastigiate pseudoparenchyma, lumina subspherical, 2 μ in diameter; algal layer about 50 μ thick, a few cells persisting, most disappearing leaving lacunae between the medullary hyphae; medulla loosely woven, heavily nubilated with brownish granules; algal layer under the parathecium about 50 μ thick, cells quite closely packed, continuous; parathecium 40–45 μ thick, of gelified fastigiate pseudoparenchyma, cells somewhat irregularly arranged above, protoplasts 2 μ in diameter; hypothecium 20 μ thick, of slender gelified periclinal hyphae; thecium 45 μ tall; paraphyses slender, dichotomous above, tips not thickened, ending 6–7 μ below the surface of the epithecial gel; asci and ascospores not seen.

Spermogonia oblate spheroidal, 150 μ tall, 225 μ in diameter, ostiole 35 μ in diameter; wall dark brown, 12–13 μ thick, pseudoparenchymatous from periclinal hyphae; spermatiophores flask shaped, base ellipsoid 3 μ in diameter, 8 μ long, tapering to a long neck 50 μ or more long, 1 μ in diameter; spermatia 8–10 $\times$ 1 μ, bacilliform, straight.

CAPE OF GOOD HOPE: Silo, *Breutel* ex herb. Sbarbaro sub *Omphalodium pachythalla*, at Farlow Herb.

OMPHALODIUM HOTTENTOTTUM (Ach.) Flotow, Linnaea 17:27. 1843.

Lichen hottentottus Ach., Lich. Suec. Prodr. 155. 1798.
Parmelia hottentotta Ach., Meth. Lich. 219. 1803.
Sticta hottentotta Ach., Syn. Lich. 231. 1814.
Imbricaria hottentotta Schwendener in Maegli, Beitr. Wiss. Bot. 3:159. 1863.

Type: Cape of Good Hope, saxicole, *Thunberg*.

Thallus 6 cm. long, probably erect or recumbent; holdfast a disc 8 mm. in diameter of radiating rootlets, base 20 mm. tall, 3 mm. wide, with two lateral branches just above the holdfast, expanding into cuneate lobes 10 mm. wide with rounded tips from which radiate secondary branches 10 mm. wide, bearing ultimate, digitate strap-shaped or cuneate lobes about 10 mm. long; all margins densely short ciliate, clay color shading to pinkish buff, white reticulate; underside clay color, nude at the base, secondary lobes black, short rhizinose; upper cortex 20 μ thick, of fastigiate thinwalled pseudoparenchyma, cells 4–5 μ in diameter, heavily nubilated with brownish granules in the outer 10–12 μ; algal layer 20 μ thick, continuous, cells 5 μ in diameter; medulla C–, K and KC orange next the algal layer, the rest negative, 160 μ thick, of moderately closely woven longitudinal hyphae 4–5 μ in diameter, somewhat incrusted with hyaline crystals, not nubilated; lower cortex 15–20 μ thick, gelified, fastigiate, hyphae 3–4 μ in diameter, outer portion dark brown; rhizinae 80 μ in diameter.

Apothecia in the center of the tertiary lobes, up to 12 mm. in diameter, urceolate at first with inrolled entire margins, finally flattened, exciple minutely scrobiculate and very short ciliate; disc imperforate, auburn, darkening; amphithecial cortex 50 μ thick, gelified, fastigiate, lumina 1.5 μ in diameter; algal layer about 65 μ thick, continuous, in places disappearing; medulla loosely woven; algal layer under the parathecium 65 μ thick, continuous; parathecium 60 μ thick, of fastigiate thickwalled pseudoparenchyma, lumina 2 μ in diameter in the lower half, of periclinal pseudoparenchyma in the upper half; hypothecium 15 μ thick, of thinwalled, closely woven periclinal hyphae 2 μ in diameter; thecium 50 μ tall; paraphyses slender, septate, about twice dichotomous above the asci, tips slightly clavate, reaching the surface of the brownish epithecial gel; asci clavate, 40 $\times$ 13 μ, wall thin, tips 3 μ thick, 8-spored; ascospores ellipsoid, 10 $\times$ 5 μ, with a moderately thick epispore, spuriously 2-celled.

CAPE OF GOOD HOPE: Silo, truncicole, *Breutel*, ex herb. Sbarbaro sub *P. hottentotta*, at Farlow Herb.

OMPHALODIUM **mazoense** Dodge, sp. nov.

Type: Southern Rhodesia, Mazoe, 1320 m., on dead wood, *Frederick Eyles 420*, at Kew.

Thallus 3 cm. diametro, citrino-ravus, lobis 1 mm. longitudine, 5 mm. latitudine, marginibus integris, apicibus subtruncatis, rotundatis, crenatisve, ciliatis; gomphus eccentricus, 5 mm. diametro, lobulatus; inferne niger, dense rhizinosus, rhizinis ad 2 mm. longitudine, ramosis; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5–6 μ diametro, granulis brunneis nubilatis; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K–, C–, KC–, 65–80 μ crassitudine, hyphis longi-

tudinalibus 3 μ diametro; cortex inferior niger, 15 μ crassitudine, pseudoparenchymatice fastigiatus gelifactusque, luminibus 1 μ diametro.

Apothecia urceolata, ad 20 mm. diametro, primum sessilia, dein stipitata, stipite 7 mm. altitudine, 4 mm. diametro, longitudinaliter sulcato, margine crenulato, excipulo scrobiculato, dorsis rugarum albidis sed non rimosis; disco concavo, perforato, castaneo; cortex amphithecialis 80 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis 4 μ diametro, luminibus 1 μ, non nubilatis; stratum algarum 16–20 μ crassitudine, subcontinuum, coloniis discretis; medulla laxe contexta; stratum algarum sub parathecio 20–30 μ crassitudine, coloniis densis; parathecium 15 μ crassitudine, hyphis periclinalibus, 3 μ diametro, luminibus 2 μ, cellulis subisodiametricis; hypothecium 7–10 μ crassitudine, hyphis tenuibus periclinalibus; thecium 65 μ altitudine; paraphyses tenues, septatae, non ramosae, cellula ultima pyriformi, 3 μ diametro; asci clavati, 40 $\times$ 12–13 μ, leptodermei, apicibus juventute incrassatis; ascosporae octonae, late ellipsoideae, 12–13 $\times$ 6–7 μ.

Thallus about 3 cm. in diameter, citrine drab shading toward wood brown, lobes 5 mm. wide, 10 mm. long, margins entire, tips subtruncate to more rounded and crenate (variously lacerate) probably short ciliate (a few broken stumps of cilia present); gomphus somewhat eccentric, 5 mm. in diameter, lobulate; underside black to margins, very densely rhizinose, rhizinae up to 2 mm. long, much branched and interwoven; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with brownish granules in the upper 10 μ; algal layer 15 μ thick, of discrete colonies of *Trebouxia*, cells 6–7 μ in diameter, forming a nearly continuous layer; medulla K–, C–, KC–, 65–80 μ thick, of moderately closely woven longitudinal hyphae, 3 μ in diameter; lower cortex black, 15 μ thick, gelified, of fastigiate pseudoparenchyma, lumina 1 μ in diameter, the outer portion very dark brown, lighter next the medulla.

Apothecia up to 20 mm. in diameter, urceolate at first nearly sessile, becoming stipitate; stipe 7 mm. tall, 4 mm. in diameter with longitudinal ridges; margins crenulate, exciple deeply scrobiculate, ridge very high below, lower above, top of ridges white but not rimose; disc chestnut, paler when moist, somewhat uneven, remaining concave, perforate; amphithecial cortex 80 μ thick, of fastigiate thick-walled pseudoparenchyma, lumina 1 μ in diameter, hyphae 4 μ, not or only slightly nubilated; algal layer 15–20 μ thick, subcontinuous, of discrete colonies; medulla loosely woven with small air spaces next the algal layer below, more closely woven above; algal layer under the parathecium 20–30 μ thick, of closely packed colonies; parathecium 15 μ thick, of conglutinate periclinal hyphae 3 μ in diameter, lumina 2 μ, forming a pseudoparenchyma; hypothecium 7–10 μ thick, of slender, periclinal hyphae; thecium 65 μ tall; paraphyses slender, septate, unbranched, terminal cell pyriform, 3 μ in diameter; asci clavate, 40 $\times$ 12–13 μ, thinwalled, tips thickened when young; ascospores broad ellipsoid, 12–13 $\times$ 6–7 μ.

SOUTHERN RHODESIA: Mazoe, 1320 m., on dead wood, *Frederick Eyles 420*, at Kew.

OMPHALODIUM **umbilicatum** (Del.) Dodge, comb. nov.

Sticta hottentotta v. *umbilicata* Del., Hist. Lich. Sticta 135. 1822.

Type: Cape of Good Hope, com. Gaudichaud.

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FLORA OF PANAMA

BY

ROBERT E. WOODSON, JR.

AND

ROBERT W. SCHERY

AND COLLABORATORS

PART VII

Fascicle 4

ONAGRACEAE (P. A. Munz)

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ANNALS

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Vol. XLVI SEPTEMBER, 1959 No. 3

FLORA OF PANAMA

Part VII. Fascicle 4*

ONAGRACEAE

By PHILIP A. MUNZ

Herbs or more rarely shrubs or even trees, with simple alternate or opposite, sometimes whorled leaves. Stipules lacking or small, caducous. Flowers mostly bisexual, axillary or in terminal racemes or paniculate clusters, the parts mostly in 4's, sometimes 2's, 5's or 6's. Floral tube** (hypanthium) adnate to ovary and usually prolonged beyond into a funnelform or tubular structure at the summit of which are the sepals, petals and stamens. Sepals 4, or 2, 5, or 6. Petals 4, or 2, 5, or 6. Stamens as many or twice as many as the petals, sometimes half as many; if of 2 series, those at the base of the petals often shorter. Anthers mostly linear, sometimes elliptical or subglobose, longitudinally dehiscent. Ovary inferior, 4, sometimes 2- or 5- or 6-loculed; style 1; stigma lobed or capitate or discoid. Fruit a capsule or berry or indehiscent and nutlike.

About 20 genera and 600 species of wide distribution, but especially west American.

a. Sepals persistent; floral tube not prolonged beyond the ovary.
  b. Stamens 8–12, in 2 series, an episepalous and an epipetalous..... 1. JUSSIAEA
  bb. Stamens 3–6, in 1 series, episepalous..... 2. LUDWIGIA
aa. Sepals deciduous after anthesis; floral tube prolonged beyond the ovary.
  b. Fruit a capsule, dehiscent; plants herbaceous.
    c. Flowers regular; stamens 8, all fertile..... 3. OENOTHERA
    cc. Flowers irregular; stamens 2, 1 fertile and 1 petaloid..... 4. LOPEZIA
  bb. Fruit a berry; plants shrubby or arborescent..... 5. FUCHSIA

1. JUSSIAEA L.

JUSSIAEA L. Gen. Pl. ed. 5, 183 (no. 478), 1754.

Jussieua L. Gen. Pl. ed 1, 126. 1737.
Corynostigma Presl, Epim. Bot., 218. 1850.
Cubospermum Lour., Fl. Cochin., 275. 1790.
Oldenlandia P. Br., Hist. Jamaic., 208. 1756.

* Assisted by a grant from The National Science Foundation.

** As used in this paper, "floral tube" will refer only to the free portion above the ovary and "ovary" will be applied to the adnate portion.

Issued October 15, 1959.

Herbs, shrubs or small trees with alternate, simple, membranaceous or rarely coriaceous leaves. Flowers yellow to white, on short or long pedicels, mostly in axils of more or less reduced upper leaves, hence sometimes paniculate; with 2 bracteoles on pedicel or ovary. Floral tube adnate to ovary and scarcely or not prolonged beyond it. Sepals 4–5 (–6), acute, persistent. Flowers regular; petals 4–5 (–6), caducous; stamens in 2 series, twice as many as petals and inserted with them under the margin of the epigynous usually hairy disc; filaments short; anthers ovate or oblong; pollen usually in tetrads. Ovary elongate, cylindrical or prismatic or obconic, 4–5 (–6) -loculed, with central placentation; style simple, more or less produced above the disc; stigma capitate, 4–5 (–6) -lobed. Ovules many. Capsule cylindrical, prismatic or obconic, 4–6-loculed, loculicidally and septicidally dehiscent. Seeds pluriseriate and naked, with prominent raphe, or uniseriate and surrounded by endocarp.

A genus of ca. 40 species, found in wet places in the warmer regions of Old and New Worlds, but concentrated in the American tropics and especially in Brazil. In recent years included by some writers in *Ludwigia*, and perhaps correctly so. American species of these genera seem to the author to fall into two distinct enough groups to merit generic status. Until more African and Asiatic plants can be studied, it seems best to maintain the present treatment.

a. Seeds multiseriate in each locule of the capsule, free (not enclosed in persistent endocarp); flowers mostly 4-merous, if 5-merous, then with capsule obconic or obpyramidal.
b. Raphe distinctly smaller than the body of the seed; capsule obconic or obpyramidal (Section *Myrtocarpus*).
c. Plants floating herbs, rooting freely along the stems.
d. Leaves crowded in terminal rosettes, the blades rhombic-ovate, 0.5–2 cm. long, strigose beneath; seeds curved toward the apex. 1. J. SEDIOIDES
dd. Leaves well distributed, the blades oblanceolate to obovate, 1–3 cm. long, glabrous; seeds straight..... 2. J. INCLINATA
cc. Plants erect or ascending, herbs or shrubs, not floating.
d. Annual herbs with flat triangular bracteoles ca. 0.5 mm. long; capsules oblong-linear, sessile or short-pedicelled, 4–5-angled, 2.5–4 mm. broad.
e. Leaves short-petioled; stems strongly angled; sepals 3–4 (–6) mm. long; petals 4–5 mm. long..... 3. J. ERECTA
ee. Leaves sessile; stems winged; sepals 7–10 mm. long; petals 8–12 mm. long..... 4. J. DECURRENS
dd. Perennial herbs or shrubs; bracteoles usually longer; capsules usually long-pedicelled (except in *J. latifolia*) and wider.
e. Flowers small, sepals 4–5 mm. long; petals 4–6 mm. long; capsule almost round; pedicels 2–3 mm. long at anthesis..... 5. J. LATIFOLIA
ee. Flowers larger; sepals 8–18 mm. long; petals 10–27 mm. long; capsule more or less angled; pedicels 5–50 mm. long at anthesis.
f. Principal lateral veins of leaf 6–12 on each side of midrib; stamens unequal, the episepalous somewhat longer than the epipetalous.
g. Pedicels at anthesis 10–20 mm. long; style 1.5–2 mm. long between disc and stigma; seeds curving at apex; disc elevated; pedicels ascending..... 6. J. NERVOSA
gg. Pedicels at anthesis 5–12 mm. long; style 3–4 mm. long between disc and stigma; seeds straight; disc plane; pedicels tend to recurve in bud..... 7. J. LITHOSPERMIFOLIA
ff. Principal lateral veins of leaf 12–30 on each side of midrib; stamens subequal.

g. The lateral veins mostly 20–30 on each side of leaf-midrib; pedicels 1–2 cm. long at anthesis; bracteoles 1–1.5 cm. long at anthesis, to 2.5 cm. in fruit; petals 1–1.2 cm. long..... 8. J. FOLIOBRACTEOLATA
gg. The lateral veins 12–22 on each side of leaf-midrib; pedicels 2–3.5 cm. long at anthesis; bracteoles 0.5–1.2 cm. long; petals 1.2–2.7 cm. long..... 9. J. PERUVIANA
bb. Raphe so much enlarged as to be almost equal to the body of the seed; capsule cylindrical. (Section *Macrocarpon*)..... 10. J. SUFFRUTICOSA
aa. Seeds uniseriate in each locule of the capsule (except in upper portions of capsule of *J. linifolia*), each seed surrounded by persistent endocarp; flowers 5–6-merous (4-merous in *J. linifolia*). (Section 3. *Jussiaea*).
b. Flowers 4-merous; capsule somewhat enlarged toward the apex, the seeds uniseriate at base and enclosed in endocarp, multiseriate and not so enclosed above..... 11. J. LINIFOLIA
bb. Flowers 5–6-merous; seeds uniseriate throughout and enclosed in endocarp.
c. Seeds free in the horseshoe-shaped endocarp; petals 5–10 mm. long.
d. Leaves lanceolate to lance-linear, mostly 2–20 mm. wide; sepals 5–8 mm. long; disc flat; style 2–4 mm. long to base of stigma; raphe one-sixth to one-eighth of the width of the seed body..... 12. J. LEPTOCARPA
dd. Leaves ovate to elliptic, mostly 15–30 mm. wide; sepals 3.5–5 mm. long; disc elevated; style 1.5–2 mm. long below base of stigma; raphe one-third to one-fourth the width of the seed-body..... 13. J. AFFINIS
cc. Seeds grown fast to the endocarp, almost completely covered by it; petals 10–20 mm. long.
d. Petals white; leaf-blades almost round; floating plants with conspicuous spongy pneumatophores from the nodes..... 14. J. NATANS
dd. Petals yellow; leaf-blades usually definitely longer than broad; floating or erect, not usually showing nodal tufts of spindle-shaped pneumatophores.
e. Flowering stems usually erect, with lance-linear to narrowly oblong leaves; bracteoles lanceolate; capsules 3–4 mm. thick. 15. J. URUGUAYENSIS
ee. Flowering stems usually floating or creeping, with oblong leaves; bracteoles deltoid; capsules mostly 2–3 mm. thick..... 16. J. REPENS

1. JUSSIAEA SEDIOIDES Humb. & Bonpl., Pl. Aequin. 1:13–15, *pl. 3, A.* 1805.

Ludwigia sedioides Hara, Journ. Jap. Bot. 28:294. 1953.

Floating herb; stems slender, green, quite glabrous, rooting freely at nodes, with long quite naked branches and leaves crowded in terminal rosettes; petioles somewhat flattened, often reddish, glabrous or somewhat strigose beneath, 1–9 cm. long; leaf-blades rhombic-ovate, rather thick, acute at base, more obtuse at apex, crenate-serrate in upper half, minutely glandular-punctate, glabrous and shining above, finely strigose beneath, 5–20 mm. long and wide, with ca. 6 inconspicuous veins on each side of midrib and no submarginal vein; flowers solitary, in a few axils only; pedicels 1–3 cm. long; bracteoles swollen, less than 1 mm. long; sepals 4 (5), glabrous, oblong-ovate, obtusish to acute, 5-nerved, 6–8 mm. long, 3–5 mm. wide; petals yellow, round-obovate, emarginate, subsessile, 10–13 mm. long, 8–10 mm. wide; disc quite plane, hairy; stamens subequal, glabrous, the filaments white, somewhat widened basally, 3–4 mm. long; anthers 2 mm. long; style white, 3.5 mm. long; stigma subcapitate, somewhat 4-lobed, ca. 2 mm. wide; ovary obconic, 4-angled, glabrous, 8–10 mm. long; capsule narrowly obconic, 4-angled, glabrous, 10–13 mm. long, 3 mm. wide at summit, sometimes without median nerve on each face; seeds brown, shining, narrowly obovoid, curved at apex, ca. 0.6 mm. long, with inconspicuous raphe.

In quiet water. Cuba and Jamaica, Guatemala, Honduras and El Salvador, Panama, Colombia to Guiana, Brazil and Bolivia.

COCLÉ: Penonomé, *Williams 88*.

2. JUSSIAEA INCLINATA Link f., Suppl., 577. 1781.

Jussiaea inclinata var. *amazonica* Mich. in Martius, Fl. Bras. XIII, pt. 2:159. 1875.
J. repens var. *inflata* Wright ex Griseb., Cat. Pl. Cubens., 107. 1866.
Jussiaea inflata Wright, Jour. Linn. Soc. 10:478. 1869.

Floating herb; submerged stems strongly inflated, sparingly branched, rooting freely at nodes; emergent stems glabrous, simple, 5–15 cm. long; submerged leaves sometimes linear to narrowly oblanceolate, very thin, subsessile or very short-petioled, 1–3 cm. long, 0.2–0.7 cm. wide; aerial leaves broadly oblanceolate to obovate, acute at base, obtuse at apex, entire, glabrous, pellucid-punctate, thickish, shining, the blades 2–8 cm. long, 1–3 cm. wide, with 10–12 fairly prominent principal lateral veins on each side of midrib and with submarginal vein; petioles 1–2.5 cm. long, flattened; flowers occasional in upper axils; pedicels 0.3–0.7 cm. long, reflexed after anthesis; bracteoles at base of ovary, swollen, scarcely 1 mm. long; sepals 4, ovate, obtuse to acute, 5–10 mm. long, 2–6 mm. wide, 5–7-nerved; petals yellow, broadly obovate, 6–14 mm. long; disc almost plane, hirsute; stamens somewhat unequal, glabrous; filaments 3–6 mm. long; anthers 2–3 mm. long; style 3–5 mm. long; stigma 4-lobed, subcapitate, 2 mm. wide; ovary obconic, 4-angled, glabrous, 5–10 mm. long; capsule obconic, 4-angled (the angles almost wing-margined), 1–2 cm. long, 3–4.5 mm. wide, with median nerve on each face; seeds oblong, brownish, smooth, shining, 0.5 mm. long, straight, the raphe not very prominent.

In quiet water. Cuba and Isle of Pines, southern Mexico, El Salvador, Panama to Guiana and Brazil.

VERAGUAS: hills west of Soná, *Allen 1056*. PANAMÁ: swamp east of Río Tecumen, *Standley 26660*.

3. JUSSIAEA ERECTA L., Sp. Pl., 388. 1753.

Ludwigia erecta Hara, Journ. Jap. Bot. 28:292. 1953.
Jussiaea Onagra Mill., Gard. Dict., ed. 8, no. 4. 1768.
Jussiaea acuminata Swartz, Fl. Ind. Occ. 2:745. 1800.
Ludwigia acuminata Gomez, Anal. Hist. Nat. Madrid 23:66. 1894.
Jussiaea acuminata vars. *longifolia* & *latifolia* Griseb., Cat. Pl. Cubens., 107. 1866.
Jussiaea ramosa Jacq. f. ex Reichb., Ic. Bot. Exot., 54, no. 75. 1827.
Jussiaea erecta vars. *Sebana* and *Plumeriana* DC., Prodr. 3:55. 1828.
Jussiaea Plumeriana Bello, Anal. Soc. Esp. Hist. Nat. 10:267. 1881.
Jussiaea declinata Sessé & Moçiño, Fl. Mex., ed. 2, 110. 1894.

Erect annual, 4–25 dm. tall, freely branched, the branches nearly or quite glabrous, sharply angled from below the decurrent leaf-bases; leaves broadly to narrowly lanceolate, acute at both ends or acuminate at apex, glabrous except for the scabrellous margins and sometimes the veins on the under surface, subentire, with 16–25 fairly prominent veins on each side of the midrib and with sub-marginal vein; petioles 2–15 mm. long; principal cauline leaf-blades 5–13 cm.

long, 1–3 cm. wide, the uppermost and those on lateral branchlets much reduced, 2–4 cm. long; flowers solitary in uppermost axils, in an open paniculoid inflorescence, subsessile or on pedicels to 2 mm. long; bracteoles near base of ovary, scalelike, barely 0.5 mm. long; sepals 4, lance-ovate, sharply acute, puberulent, 3–4 mm. long; petals yellow, obovate, sessile, 4–5 mm. long; disc plane, almost glabrous; stamens subequal, glabrous, ca. 1.5 mm. long; anthers ca. 0.6 mm. long; style 1 mm. long; stigma capitate, 1 mm. thick; ovary oblong-linear, 4-angled, puberulent, 7–10 mm. long; capsule 4-angled, oblong-linear, puberulent, 12–16 mm. long, each face 2–2.5 mm. wide, with or without midrib; seeds yellow-brown, thick cylindro-ovoid, ca. 0.4 mm. long, minutely cellular-pitted under high magnification, with evident raphe.

Ditches and wet places. Southern Florida, West Indies, Mexico to Peru and Paraguay; also in tropics of Old World.

CHIRIQUÍ: Puerto Armuelles, *Woodson & Schery 830*. CANAL ZONE: Culebra, *Pittier 2111*; Corozal, *Piper 5298*. PANAMÁ: San José Island, Perlas Archipelago, *I. M. Johnston 1107*.

4. JUSSIAEA DECURRENS (Walt.) DC., Prodr. 3:56. 1828.

Ludwigia decurrens Walt., Fl. Carol., 89. 1788.
Ludwigia uniflora Raf., Med. Repos. N. Y. 5:358. 1808.
Jussiaea palustris G. F. W. Meyer, Prim. Fl. Esseq., 173. 1818.
Ludwigia jussiaeoides Michx., Fl. Bor. Am. 1:89. 1820.
Jussiaea tenuifolia Nutt., Am. Jour. Sci. 5:294. 1822.
Jussiaea alata G. Don, Gen. Syst. 2:693. 1832.
Jussiaea alata Presl, Rel. Haenk. 2:34. 1835.
Jussiaea pterophora Miq., Ann. Mag. Nat. Hist., ser. 1, 11:13. 1843.
Jussiaea Bertonii Lévl. in Bertoni, Descr. Fís. Econ. Paraguay, 2. 1910.

Erect annual, 3–20 dm. tall, glabrous, freely branched; roots often spongy, inflated; stems mostly 4-winged, 2 wings from each of the decurrent leaf bases, the wings to 2 mm. wide, membranous; leaves lanceolate (uppermost almost linear, basal broadly lanceolate), membranaceous, shining, quite glabrous except for the ciliolate margins and minute appressed hairs beneath, subsessile, acute or somewhat rounded at the base, gradually attenuate into an acute apex, subentire, the veins prominent, the principal lateral veins 11–16 on each side of the midrib, submarginal vein developed; principal cauline leaves 5–12 cm. long, 1–3.5 cm. wide, the upper reduced; flowers solitary in upper axils; pedicels 1–5 (–10) mm. long, 4-angled or -winged; bracteoles at base of ovary, deltoid-ovate, less than 1 mm. long, thickened; sepals 4, green, ovate-lanceolate, acuminate, minutely puberulent, scabrellous-ciliate, 3–5-nerved, 7–10 mm. long; petals yellow, obovate, sessile, entire, 8–12 mm. long; disc plane, pubescent; stamens unequal, glabrous, the filaments 1.5–2.5 mm. long, the anthers 1 mm. long; style 1.5–2 mm. long; stigma capitate, 1.5–2 mm. thick; ovary narrowly obconic, 4-angled or -winged, minutely puberulent, 8–10 mm. long; capsule elongate clavate-obpyramidal, 4-angled or narrowly winged, mostly 12–20 mm. long, each face with a more or less obsolete midrib and 3–4 mm. wide; seeds subcylindric, obtuse at both ends, yellowish, 0.3–0.4 mm. long, minutely cellular-pitted under magnification, the raphe evident.

Wet places. Southeastern United States, West Indies, Guatemala to Peru, Uruguay and northern Argentine.

BOCAS DEL TORO: Isla Colon, near Chiriquí Lagoon, *H. von Wedel 2853*; Water Valley, near Chiriquí Lagoon, *H. von Wedel 1667*; Changuinola Valley, *V. C. Dunlap 219*. CANAL ZONE: Barro Colorado Island, *L. H. & E. Z. Bailey 384*. COCLÉ: Aguadulce, *Pittier 4925*.

5. JUSSIAEA LATIFOLIA Benth. in Hook. Jour. Bot. 2:317. 1840.

Ludwigia latifolia Hara, Journ. Jap. Bot. 28:292. 1953.
Jussiaea geminiflora J. Donnell Smith, Bot. Gaz. 23:246. 1897.

Herbaceous to arborescent, 1–5 m. high, branching freely, the branchlets subterete, subglabrous except finely puberulent when younger; main trunk to 1 dm. in diameter; petioles 5–15 mm. long; leaf-blades ovate to broadly lanceolate, acuminate at both ends, thin, nearly glabrous to finely puberulent above especially on veins, subglabrous beneath except on the pubescent veins, shining, somewhat bicolored, 5–15 cm. long, with 18–30 principal veins on each side of midrib and with evident submarginal vein; leaves not much reduced up the stem; stipules glandular-setaceous, subulate; flowers 1 or 2 in each upper leaf axil; pedicels puberulent, 2–3 mm. long at anthesis, 3–5 mm. in fruit; bracteoles lance-linear, puberulent, obtusely 4-angled, obconic, 4–5 mm. long; sepals lance-deltoid, acute to acuminate, more or less glandular-serrulate, 4–5 mm. long, somewhat more in fruit; petals yellow, round-obovate, 4–6 mm. long; disc somewhat elevated, pilose; stamens subequal, the filaments flattened, ca. 2 mm. long; anthers slightly longer; style barely 1 mm. long; stigma subglobose, ca. 1.5 mm. thick; ovary obconic, obtusely 4-angled, 4–5 mm. long; capsule subglobose to oblong, scarcely angled, subglabrous to slightly puberulent, 6–12 mm. long; seed oblong-obovoid, 0.6–0.7 mm. long, light brown, shining, obscurely punctate, the raphe not prominent.

Wet places. Costa Rica to northern Brazil and adjacent Peru.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 96*; Water Valley, *H. von Wedel 781* and *1534*; Western River near Chiriquí Lagoon, *H. von Wedel 2779*; Chiriquí Lagoon region, Punta Rovalo to Rovalo River, *Seibert 1559*; near Chiriquí Lagoon, *H. von Wedel 1384*.

6. JUSSIAEA NERVOSA Poir. in Lamarck, Encycl. Suppl. 3:199. 1813.

Ludwigia nervosa Hara, Journ. Jap. Bot. 28:293. 1953.
Jussiaea maypurensis H.B.K., Nov. Gen. et Sp. 6:100. 1823.
Jussiaea palmitensis Camb. in St. Hil., Fl. Bras. Merid. 2:261. 1829.
Jussiaea rigida Miquel, Stirp. Surinam, 58. 1851.
Jussiaea nervosa var. *glaberrima* Mich. in Martius, Fl. Bras. XIII, pt. 2:156. 1875.

Shrubby or arborescent, 1–6 m. tall (usually 1.5–3 m.), erect, freely branched, the young branchlets somewhat angled, finely puberulent; leaves fairly crowded, gradually reduced up the stems, the uppermost scarcely more than leafy bracts, all sessile or nearly so, lanceolate to lance-oblong, glabrous or more or less puberulent or pubescent along veins of under surface, coriaceous, subentire, inconspicuously gland-serrulate on margin, veins prominent especially beneath, with about 6–12 principal lateral ones on each side of midrib and other minor ones between, the

Fig. 94. ***Jussiaea lithospermifolia***

submarginal vein conspicuous; principal leaves 3–9 cm. long; flowers solitary in axils of somewhat reduced uppermost leaves of unbranched stems, or of bracteate leaves on crowded lateral branchlets; pedicels rather slender, 1–2 cm. long at anthesis, to 4 cm. in fruit; bracteoles at apex of pedicel or base of ovary, linear, adnate to stipules, 0.5–2 mm. long, quite persistent; sepals 4, deltoid-ovate, 6–9 mm. long, short-acuminate, obscurely 5-nerved; petals sulphur-yellow, round-obovate, 10–20 mm. long, scarcely clawed; disc well elevated, 1.5–2.5 mm. high, pilose; stamens unequal, episepalous filaments 4–5 mm. long, epipetalous 2–3 mm.; anthers 3–4 mm. long; style 1.5–2 mm. long; stigma capitate, 1.5–2 mm. thick; ovary obconic, 4–8 mm. long; capsule narrowly obconic to cylindro-obconic, 4-angled, 10–15 mm. long, 4–6 mm. wide on each face; seeds oblong, quite smooth, shining, yellowish, ca. 1 mm. long, the apex curved toward the side away from the fairly prominent raphe.

Wet places. British Honduras and Colombia to Paraguay.

No material seen from Panama, but since it is known from immediately north and south of Panama, it is to be expected.

7. JUSSIAEA LITHOSPERMIFOLIA Kunth in Mich., Flora 57:300. 1874.

Ludwigia lithospermifolia Hara, Journ. Jap. Bot. 28:292. 1953.
Jussiaea yacumensis Rusby, Mem. N. Y. Bot. Gard. 7:316. 1827.

Herb or shrub up to 2.5 m. tall, relatively few-branched, the ultimate branchlets very slender, finely puberulent to subglabrous, more or less angled; leaves not very crowded, sessile, narrowly lanceolate to oblong-lanceolate, rounded to long-acute at base, acute to obtuse at apex, subentire or minutely gland-serrulate, subcoriaceous, mostly glabrous, 2–7 cm. long, gradually reduced up the stems, with 9–10 prominent lateral veins on each side of the midrib and with prominent submarginal vein; flowers usually in axils of the uppermost much reduced leaves on very slender side branchlets, rather few; pedicels slender, finely puberulent to subglabrous, 5–12 mm. long at anthesis, somewhat thicker and longer in fruit, tending to be recurved and secund in the bud; bracteoles at base of ovary or at apex of pedicels, subulate, adnate to the stipules, 1 mm. long; sepals 4, lanceolate, acuminate, 8–10 mm. long at anthesis, 3-nerved with 2 fainter nerves between; petals light yellow to white, 13–20 mm. long, round-obovate, subsessile; disc pilose, scarcely elevated; stamens unequal, the filaments flattened, episepalous 4–5 mm. long, epipetalous 2.5–3 mm. long; anthers 4–5 mm. long; style 3–4 mm. long; stigma capitate, ca. 2 mm. thick; ovary obconic, 5–7 mm. long; capsule narrowly obconic, 4-angled, 10–12 mm. long, 3.5–5 mm. wide; seeds yellowish-brown, oblong, 0.7 mm. long, half as wide, straight, shining, very faintly cellular-pitted, with raphe not very prominent.

Wet places. Costa Rica to Bolivia and Brazil.

CHIRIQUÍ: Boquete, *Davidson 694*. VERAGUAS: hills west of Soná, *Allen 1055*. COCLÉ: mountains beyond La Pintada, *Hunter and Allen 527*. CANAL ZONE: Chiva-Chiva Trail, Red Tank to Pueblo Nuevo, *Piper 5747*.

8. JUSSIAEA FOLIOBRACTEOLATA Munz, Darwiniana 4:228–230. 1942.

Ludwigia foliobracteolata Hara, Journ. Bot. 28:292. 1953.

Suffruticose, 1–2 m. tall, the older stems subglabrous, the younger pubescent especially in the inflorescence; leaf-blades elliptic, acuminate at both ends, 2–5 times as long as wide, almost glabrous above except on the pubescent veins, pubescent beneath especially on the veins, 7–20 cm. long; petioles 1–4 cm. long; veins prominent, mostly 20–30 on each side of the midrib; uppermost leaves gradually reduced, each with an axillary flower; pedicels 1–2 cm. long in anthesis, 2–3 cm. in fruit; bracteoles on lower part of ovary (one-third to one-fourth way above the base), lanceolate to round-ovate, foliaceous, free from stipules, rather persistent, pinnately veined, 1–1.5 cm. long at anthesis, to 2.5 cm. in fruit; sepals 4, lance-deltoid, glandular-serrulate, acuminate, ca. 1 cm. long; petals 1–1.2 cm. long, 1–1.5 cm. wide, emarginate, the broad claw 2–3 mm. long; filaments dilated, 2–3 mm. long; anthers 2–3 mm. long; disc somewhat elevated, 1–1.5 mm. high, pilose; style 1 mm. long; stigma ca. 2 mm. thick; capsule somewhat 4-angled, 1.5–2 cm. long, 0.6–0.8 cm. thick; seeds light brown, asymmetrically obovoid, obscurely striate, 0.8 mm. long, curved on one edge, almost straight along the raphe which is one-third to one-half as wide as the body of the seed.

Wet places. Southern Mexico and Costa Rica, Venezuela, British Guiana, Trinidad. To be sought in Panama.

9. JUSSIAEA PERUVIANA L., Sp. Pl., 388. 1753.

Ludwigia peruviana Hara, Journ. Jap. Bot. 28:293. 1953.
Oenothera hirta L., Sp. Pl. ed. 2, 491. 1762.
Jussiaea hirta Sw., Obs., 142. 1791.
Ludwigia hirta Gomez, Anal. Hist. Nat. Madrid, 23. 1894.
Jussiaea hirsuta Miller, Gard. Dict., ed. 8, no. 5. 1768.
Jussiaea grandiflora R. & P., Fl. Peruv. 4:382. 1802.
Jussiaea macrocarpa H.B.K., Nov. Gen. et Sp. 6:102. 1823.
Jussiaea peruviana var. *macrocarpa* Bertoni, Descr. Fís. Econ. del Paraguay, 13. 1910
Jussiaea mollis H.B.K., l.c.
Jussiaea peruviana var. *australis* Hassler f. *hirsuta* Hassler and f. *tomentosa* Hassler, Fedde Repert. 12:269. 1913.
Jussiaea Sprengeri Hort. ex Bailey, Stand. Cyclopedia, 1730. 1915.

Suffruticose herb or shrub, 0.6–3 m. high, rarely subscandent and up to 6 m. tall, more or less hirsute-pubescent throughout, usually somewhat tawny, with open branching, the younger branchlets more or less angled; leaf blades ovate- to lance-elliptic, 3–4 times as long as wide, acute to acuminate at both ends, with 12–22 main veins on each side of the midrib, subentire, scabrous-puberulent to soft-hairy, especially beneath and along the veins, 5–15 cm. long, gradually reduced up the stem; petioles 3–10 (–15) mm. long; flowers solitary in upper axils; pedicels 20–25 mm. long at anthesis, somewhat longer in fruit; bracteoles at upper part of pedicel or on base of ovary, lanceolate to oblanceolate, free from stipules, 5–12 (–18) mm. long; sepals 4 (5), lanceolate, acuminate, more or less glandular-serrulate, 10–18 mm. long, not much enlarged in fruit; petals pale to deep yellow, round-obovate, 12–27 mm. long, emarginate, with broad claw 1.5–3 mm. long; stamens subequal,

filaments flattened, 2–3.5 mm. long; anthers 3–4.5 mm. long; disc pilose, elevated, 1–2 mm. high; style ca. 1 mm. long; stigma 2–3 mm. long; capsule 4-angled, obconic, 12–30 mm. long, 8–10 mm. thick, usually somewhat constricted at apex; seeds light brown, compressed-obovoid, 0.6–0.8 mm. long, indistinctly striate and regularly and shallowly cellular-pitted, raphe one-fourth to one-fifth the width of the body.

Wet places. From Florida and Mexico to Argentina.

BOCAS DEL TORO: Robalo Trail, north slope of Cerro Horqueta, *Allen 4945*. CHIRIQUÍ: Llanos del Volcán, *Seibert 335*; Chiquero, Boquete District, *Davidson 551*; Boquete, *Woodson & Schery 711*. COCLÉ: Llano Bonito, north of Las Margaritas, *Seibert 535*; Penonomé, *R. S. Williams 146*; El Valle de Antón, *Allen 1982*, *Hunter & Allen 374*, and *Seibert 489*; marshes near Río Antón, *Allen 2815*; near Antón, *Woodson, Allen & Seibert 1707*.

10. JUSSIAEA SUFFRUTICOSA L. var. OCTOFILA (DC.) Munz, Darwiniana 4:239. 1942.

Jussiaea octofila DC., Prodr. 3:57. 1828.
Jussiaea peruviana var. *octofila* Bertoni, Descr. Fís. Econ. del Paraguay, 13. 1910.
Jussiaea pubescens L., Sp. Pl., ed. 2, 555. 1762.
Ludwigia pubescens Hara, Journ. Jap. Bot. 28:293. 1953.
Jussiaea calycina Presl, Rel. Haenk. 2:34. 1835.
Jussiaea hirsuta Presl, l.c.
Jussiaea Haenkeana Steud., Nomen. ed. 2, 1:836. 1840.
Jussiaea venosa Presl, l.c.
Jussiaea occidentalis Nutt. ex T. & G., Fl. N. Am. 1:521. 1840.
Jussiaea clavata Jones, Contrib. W. Bot. 15:131. 1929.

Herb or shrub 0.6–2.5 m. tall, erect, branched above or throughout, pubescent on stems and leaves; leaves lanceolate to lance-ovate, 2–6 (–10) cm. long, 0.8–1.5 (–2.5) cm. wide, mostly sessile or short-petioled, acute at base, acutish to acuminate at apex, membranaceous, subentire, only gradually reduced up the stem, lateral veins 15–20 on each side of the midrib, with well developed submarginal vein; flowers solitary in uper axils; pedicels mostly 4–12 mm. long in fruit; bracteoles on upper part of pedicel or on base of ovary, setaceous, 1–3 mm. long; sepals 4, ovate to lance-ovate, 7–8 mm. long, pubescent, 5-nerved; petals deep yellow, cuneate-obovate, scarcely clawed, 1–2 cm. long; disc scarcely elevated, hairy; stamens slightly unequal, glabrous; filaments widened basally, 2.5–3.5 and 1.5–2.5 mm. long; anthers 2–3 mm. long; style thick, 1.5–3 mm. long; stigma subcapitate, slightly lobed, 2.5–3 mm. thick; ovary clavate-cylindric, mostly 10–15 mm. long; capsules cylindric to clavate-cylindric, 8-nerved, obtusely 4-angled, 2.5–5 cm. long, 2.5–3.5 mm. wide; seeds rounded, brown, shining, 0.6 mm. long, the raphe as wide as the body.

Wet places. Southeastern United States and West Indies, Mexico to Venezuela and eastern Peru.

BOCAS DEL TORO: Changuinola River, *Dunlap 464*; Water Valley, *H. von Wedel 993*; southwest of Bocas at Macaw Hills, Isla Colon, *H. von wedel 546*. CHIRIQUÍ: Boquete, *M. E. Davidson 694*.

More common in Panama is

10a. JUSSIAEA SUFFRUTICOSA var. LIGUSTRIFOLIA (H.B.K.) Griseb., Mem. Am. Acad., n. ser., 8:187. 1860.

Jussiaea ligustrifolia H.B.K., Nov. Gen. et Sp. 6:100. 1823.
Ludwigia pubescens var. *ligustrifolia* Hara, Journ. Jap. Bot. 28:293. 1953.
Oenothera octovalvis L., Sp. Pl. ed. 2, 492. 1762.
Jussiaea octovalvis, Sw. Obs. Bot., 142. 1791.
Jussiaea angustifolia Lam., Encyc. 3:331, t. 280. 1789.
Jussiaea suffruticosa var. *angustifolia* O. Kuntze, Rev. Gen. 1:251. 1891.
Ludwigia angustifolia Gomez, An. Hist. Nat. Madrid. 23:66. 1894.
Jussiaea octonervia Lam., Encyc. 3:332, t. 280. 1789.
Jussiaea suffruticosa var. *octonervia* Bertoni, Descr. Fís. Econ. del Paraguay, 17. 1910.
Jussiaea frutescens Jacq. f., Sem. Hort. Vind. (1821); ex DC., Prod. 3:56. 1828.
Jussiaea persicariaefolia forma *major* Schlecht, Linnaea 12:271. 1838.
Jussiaea Sagreana A. Rich., Ess. Fl. Cub., 534. 1845.
Ludwigia Sagreana Gomez, l.c.
Jussiaea suffruticosa var. *Sintenisii* Urb., Symb. Ant. 4:469. 1910.

Stems glabrous to strigulose especially in younger parts; leaves lanceolate to ovate, usually acute to acuminate, glabrous to somewhat strigulose, 3–12 cm. long, 0.7–2.2 cm. wide, subsessile to short-petioled (–8 mm.); fruiting pedicels generally 5–10 mm. long; bracteoles on base of floral tube, setaceous, 1–3 (–5) mm. long; sepals ovate, acuminate, 8–12 mm. long.

West Indies and Mexico to Peru and Paraguay; also in Old World.

BOCAS DEL TORO: Water Valley near Chiriquí Lagoon, *H. von Wedel 749* and *1682*; Old Bank Island near Chiriquí Lagoon, *H. von Wedel 2002* and *2054*; Changuinola Valley, Island Potrero, *Dunlap 213*. CHIRIQUÍ: Puerto Armuelles, *Woodson & Schery 829*; Boquete, *M. E. Davidson 650*. COCLÉ: Valle de Antón, *Seibert 441*. PANAMÁ: near Arraiján, *Woodson, Allen and Seibert 1349*, *Allen 1627*; Arenoso, *Seibert 618*. CANAL ZONE: Barro Colorado Island, *Shattuck 592*, *Aviles 880* and *911*, *Dodge 3457*; Gatun Lake, *Wetmore & Abbe 27*; Quebrada La Palma, *Dodge & Allen 17345*; Las Cruces Trail, *Hunter & Allen 743*; Chagres, *Fendler 114*.

Plants with narrower lance-linear leaves, 2–5 mm. wide are forma LINEARIFOLIA (Hassler) Munz, Darwiniana 4:243. 1942. [*J. suffruticosa* var. *linearifolia* Hassler, Fedde Repert, 12:277. 1913. *J. salicifolia* H.B.K., Nov. Gen. et Sp. 6: 99. 1823. *J. parviflora* Camb. in St. Hilaire, Fl. Bras. Merid. 2:263. 1829. *J. suffruticosa* var. *angustifolia* Chod. & Hassler, Bull. Herb. Boiss. ser. II, 3:909. 1903, not O. Kuntze, Rev. Gen. 1:251. 1891.] It has the range of the var. *ligustrifolia*.

COCLÉ: Valle de Antón, *Seibert 441*; Porto Posada near Penonomé, *Williams 150*. PANAMÁ: road to Chepo, *Hunter & Steyermark* in *1935*.

11. JUSSIAEA LINIFOLIA Vahl, Eclog. Am. 2:32. 1798.

Jussiaea micrantha Kunze, Linnaea 24:177. 1851.
Ludwigia micrantha Hara, Journ. Jap. 28:293. 1953.
Jussiaea Weddellii Micheli, Flora 57:301. 1874.

Erect annual, 2–20 dm. tall, subglabrous, usually freely branched, the branches wing-angled from below the decurrent leaf bases; leaves lanceolate to ovate, gradually narrowed at base into flattened petioles 2–20 mm. long, acute to subacuminate, pellucid-punctate, membranaceous, glabrous except for minute

pubescence on scabrellous margins and veins of under surface or scattered over both surfaces, subentire, with ca. 12–16 main veins on each side of midrib and with poorly developed submarginal vein; principal cauline lvs. 3–10 cm. long, 1–3 cm. wide, gradually reduced up the stem; flowers white, many, solitary in upper axils, arranged in subpaniculate puberulent inflorescence, subsessile; bracteoles triangular, adnate to stipules, scalelike, 0.5–1 mm. long, high on ovary; this linear, enlarged above, 4-angled, puberulent, ca. 8 mm. long; sepals 4, lanceolate, 3-nerved, acuminate, 2.5–3.5 mm. long; petals 4, elliptic, entire, 3 mm. long; disc plane; filaments unequal, slender, 1 and 2 mm. long; anthers barely 0.5 mm. long; style slender, 1.5 mm. long; stigma subcapitate, less than 1 mm. thick; capsule sublinear, slightly enlarged in upper fifth to half, subterete, 18–25 mm. long, 1.5–2 mm. thick, fairly thick-walled and slow to dehisce below, membranaceous and easily dehiscent above; seeds usually pluriseriate in upper part, subhorizontal, oblong-ovoid, ca. 0.5 mm. long, yellowish, minutely cellular-punctate under magnification, with evident raphe; lower seeds uniseriate, almost pendulous, 0.7 mm. long, oblong-ovoid, cellular-punctate, with well developed raphe and embedded in a persistent corky thick angled endocarp.

Moist places. West Indies and southern Mexico to Peru and Brazil. Old World. No material seen from Panama, but the species is known to occur in Costa Rica and northern Colombia.

12. JUSSIAEA LEPTOCARPA Nutt., Gen. N. Am. 1:279. 1818.

Ludwigia leptocarpa Hara, Journ. Jap. Bot. 28:292. 1953.
Jussiaea pilosa H.B.K., Nov. Gen. et Sp. 6:101. 1823.
Jussiaea variabilis var. *pilosa* O. Kuntze, Rev. Gen. 1:251. 1891.
Jussiaea Schottii Micheli, Flora 57:302. 1874.
Jussiaea surinamensis Miq., Linnaea 18:370. 1844.
Jussiaea pilosa var. *robustior* J. Donn. Smith, Bot. Gaz. 16:6. 1891.
Jussiaea pilosa var. *pterocarpa* Hassler, Fedde Repert. 12:274. 1913.
Jussiaea pilosa var. *glabra* Hoehne, Exped. Sci. Roosevelt-Rondon Annexo 2:62. 1914.

Annual or perennial herb or shrub, 0.3–2 m. tall, freely branched, bushy, the younger branches angled even almost winged from below the decurrent leaf bases, pilose and minutely puberulent; leaves numerous, lanceolate, acute or obtuse, minutely scabrellous-puberulent, often almost strigose or pilose, especially on the veins of the under surface; main leaves 4–14 cm. long, 0.7–2.8 cm. wide, with 11–20 principal veins on each side of the midrib and with poorly developed submarginal vein, subsessile to petioled (to 2 cm. long); flowers solitary in upper axils, rather numerous; pedicels becoming 3–15 mm. long in fruit; bracteoles at upper end of pedicel, adnate to stipules, squamate, ca. 0.5 mm. long; sepals 5–6, lanceolate, acuminate, 5–8 mm. long, inconspicuously 3-nerved; petals whitish to deep yellow, round-obovate, 5–10 mm. long, short-clawed; disc flat, pilose; stamens unequal, glabrous, the episepalous filaments 2.5–4.5 mm. long, the epipetalous 1.5–2.5 mm.; anthers ca. 1 mm. long; style 2–4 mm. long; stigma capitate, 1–1.5 mm. thick; ovary linear, subterete, 10–16 mm. long, pilose and puberulent; capsule subcylindric, 10–12-nerved, straight or curved, rather abruptly narrowed at base,

18–45 mm. long, 2.5–3 mm. thick, puberulent and pilose; seeds subhorizontal, in 1 series in each locule, flattened-ovoid, yellowish, 1 mm. long, minutely cellular-punctate under magnification, surrounded by the horseshoe-shaped corky endocarp but free in it; raphe one-sixth to one-eighth as wide as the body of the seed.

Wet places. Southeastern United States and West Indies, Mexico to Peru and Argentina.

COCLÉ: near Antón, *Woodson, Allen & Seibert 1708.* CANAL ZONE: Barro Colorado Island, *Wetmore & Abbe 189, Woodworth & Vestal 533, Bailey 650*; Gigante Bay, *Dodge 3473*; Gamboa, *Allen 1974.*

12a. JUSSIAEA LEPTOCARPA var. MEYERIANA (O. Kuntze) Munz, Darwiniana 4: 258. 1942.

Jussiaea variabilis var. *Meyeriana* O. Ktze., Rev. Gen. Pl. 1:251. 1891.
Jussiaea variabilis Meyer, Primit. Fl. Essequeb., 174. 1818.
Jussiaea aluligera Miq., Stirp. Surinam Sel., 60. 1851.

Plant glabrous; fruiting pedicels 1–5 mm. long.
West Indies, Panama to Guiana and Brazil.

CHIRIQUÍ: Boquete, *Woodson & Schery 712, Davidson 650.*

13. JUSSIAEA AFFINIS DC., Prodr. 3:53. 1828.

Jussiaea variabilis Mey. var. *affinis* O. Kuntze, Rev. Gen. Pl. 1:251. 1891.
Ludwigia affinis Hara, Journ. Jap. Bot. 28:291. 1953.
Jussiaea micropetala Martius, Flora 22: Beibl. 1:61. 1839.
Jussiaea hexamera Miq., Ann. Sci. Nat., Ser. III, 1:36. 1844.
Jussiaea ferruginea Rusby, Bull. N. Y. Bot. Gard. 8:110. 1912.

Herbs or straggling half shrubs, 0.5–2.5 m. tall, supported by surrounding plants, openly branched, the branches slender, hirsute-pilose with brownish hairs, angled; leaves ovate to elliptic, acute at base and rather abruptly narrowed into petioles 3–10 (–25) mm. long, abruptly acute or obtusish at apex, membranaceous, entire, minutely pellucid-punctate, pilose on both surfaces, with 10–25 rather conspicuous veins on each side of midrib and rather inconspicuous submarginal vein; leaf blades 2–8 (–12) cm. long, 1.5–3 (–6) cm. wide, the uppermost somewhat smaller; flowers solitary in leaf axils; pedicels 1–3 mm. long; bracteoles at base of ovary, squamate, triangular, apparently adnate to stipules, less than 0.5 mm. long; sepals 5–6, lance-ovate, acute, 3.5–5 mm. long, 1.5 mm. wide, obscurely 3-nerved; petals yellow, narrowly obovate, 6–8 mm. long; disc elevated, pilose; stamens unequal, the filaments flattened basally, 1.5 and 3 mm. long; anthers ca. 1 mm. long; style 1.5–2 mm. long; stigma capitate, barely 1 mm. thick; ovary usually short-hirsute, linear, cylindrical, 5–6-nerved, 10–12 mm. long; capsules cylindrical, 10–12-nerved, 20–35 mm. long, 2.5–3 mm. thick; seeds thick-ovoid, yellowish, ca. 1 mm. long, obscurely cellular-pitted under magnification, the raphe one-third to one-fourth as wide as the body, seed enveloped in the horseshoe-shaped corky endocarp.

Wet places. Southern West Indies and Guatemala to Peru, Bolivia and Brazil.

BOCAS DEL TORO: Old Bank Island near Chiriquí Lagoon, *H. von Wedel 1884* and *2162.* COCLÉ: Penonomé, *R. S. Williams 392.* CANAL ZONE: Chagres, *Fendler 115.*

13a. JUSSIAEA AFFINIS var. DODECANDRA (DC.) Munz, Darwiniana 4:261. 1942.

Jussiaea dodecandra DC., Prodr. 3:53. 1828.

Young stems, floral tubes and sepals minutely puberulent.

Costa Rica to Guiana.

BOCAS DEL TORO: Changuinola River, *Dunlap 391*.

14. JUSSIAEA NATANS Humb. & Bonpl., Pl. Aequin. 1:16. 1808.

Jussiaea natans var. *emersa* Hassler, Fedde Repert. 12:276–277. 1913.
Jussiaea helminthorrhiza Martius, Flora 22: Beibl. 1:61. 1839.
Ludwigia helminthorrhiza Hara, Journ. Jap. Bot. 28:292. 1953.

Perennial herb, floating or prostrate on mud, rooting at nodes, some of the roots slender, branched, others apparently converted into spongy masses or pneumatophores 2–4 mm. thick and spindle-shaped; stems glabrous, few branched, leafy, scarcely if at all angled; leaves suborbicular to short-oblong, obtuse at base, narrowed abruptly into flattened glabrous petioles 1–4 cm. long, truncate to obtuse at apex, entire, shining and glabrous above, glabrous beneath, somewhat fleshy, veins quite conspicuous, about 8–12 principal ones on each side of midrib, submarginal vein weakly developed; leaf-blades 1.5–5 cm. long, 1.5–3.5 cm. wide, not much reduced up the stem; flowers solitary in the axils; pedicels 1–5 cm. long, glabrous; bracteoles at apex of pedicel, squamate, 0.5 mm. long, thickened; sepals 5 (sometimes 4), lance-ovate, 4–6 mm. long, acute, 3–5-nerved; petals white with basal yellow spot, oblong-obovate, 8–14 mm. long, 7–10 mm. wide, with short broad claw; disc flat, pilose; stamens unequal, filaments flattened at base, 4–5 and 3–3.5 mm. long; anthers 1–2 mm. long; style 4–7 mm. long, white, stigma green and capitate, somewhat lobed, 1.5 mm. wide; ovary linear, cylindrical, glabrous, 9–12 mm. long; capsule subcylindric, sometimes curved, 10- (8-) nerved, gradually narrowed at base, 2–3 cm. long, 2.5–3 mm. thick, fairly thick-walled, sometimes externally marked into transverse divisions by the contained seeds; seeds in 1 row in each locule, completely invested by and adnate to the shining hard angular pale brown endocarp which is 1.5 mm. long.

Usually in water. Southern Mexico to Peru and Paraguay.

CANAL ZONE: Gatun Lake, *Seibert 604, Cowell 310*; Barro Colorado Island, *Woodworth & Vestal 544, Aviles 24, Shattuck 410 & 1132, Bangham 510, Salvoza 936*; Ahorca Lagarto to Culebra, *Cowell 382*; Río Chagres, *Fairchild 2107* and *2042*; Madden Lake, *Woodson & Schery 959*.

15. JUSSIAEA URUGUAYENSIS Camb. in St. Hilaire, Fl. Bras. Merid. 2:264. 1829.

Ludwigia urugayensis Hara, Journ. Jap. Bot. 28:294. 1953.
Jussiaea grandiflora Michx., Fl. Bor. Am. 1:267. 1803, not *J. grandiflora* R. & P., 1802.
Jussiaea repens var. *grandiflora* Mich. in Martius, Fl. Bras. XIII, pt. 2:167. 1875.
Ludwigia clavellina var. *grandiflora* Gomez, Anal. Hist. Nat. Madrid 23:66. 1894.
Jussiaea stenophylla Gillies ex Hook., Bot. Misc. 3:312. 1833.
Jussiaea Stuckerti Lévl., Bull. Acad. Geogr. Bot. 17:210. 1907.
Jussiaea repens var. *hispida* Hauman-Merck, Anal. Mus. Nac. Buenos Aires 24:406. 1913.
Jussiaea grandiflora formae *natans, semimersa* and *terrestris* Glueck, Beihefte Bot. Centralbl. 39:355–356. 1923.
Jussiaea Michauxiana Fernald, Rhodora 46:197. 1944.

Perennial herb from creeping rhizome, rooting freely at nodes, sometimes also bearing pneumatophores, stems usually reddish and of three possible types: (1) slender, floating, scarcely branched, glabrous, 3–10 (–15) dm. long and with leaves remote, floating, oblong or obovate, glabrous, 1–4 cm. long, 1–1.5 cm. wide, obtuse, entire, narrowed gradually or abruptly into slender petioles 1–2 cm. long; (2) erect or ascending, succulent or even somewhat woody, usually soft-hirsute, somewhat angled, simple or freely branched, 3–6 dm. high, with leaves rather crowded, ascending, linear-lanceolate to oblanceolate or oblong, the lower spatulate to obovate, entire, mostly soft-hairy, usually gland-mucronate, narrowed gradually into winged petioles 1–5 (–25) mm. long, with ca. 10–12 principal fairly prominent veins on each side of midrib, the submarginal vein scarcely developed, leaf-blades 3–6 (–10) cm. long, 0.3–1 (–3) cm. wide, often with fascicles of reduced leaves in axils; stipules deltoid, gland-thickened; and (3) compact, much branched, creeping, rooting freely at nodes, thus forming mats on sand or mud, the stems 1–10 dm. long, pubescent; leaves spatulate to oblanceolate, 0.5–1.8 cm. long, usually pubescent, very short-petioled, with axillary fascicles; flowers solitary in axils on erect type of branch; pedicels 1–2 (–5) cm. long, spreading or reflexed in fruit, glabrous to hairy; bracteoles at base of ovary, lanceolate, 0.5–1 mm. long; ovary sublinear, 7–10 mm. long, hairy; sepals 5 (6), lanceolate, acute, hairy, 6–13 mm. long, indistinctly 3-nerved; petals bright yellow, oblong-ovate, 12–20 mm. long, emarginate, short-clawed; disc plane, pilose; stamens unequal; filaments 3–4 and 2–3 mm. long; anthers 2–3 mm. long; style slender, 4–5 mm. long; stigma capitate, 1.5–2 mm. thick; capsule subcylindric, 10-nerved, usually hairy, plainly marked externally by the contained seeds, abruptly narrowed at the base, but not at all at the apex, 1.3–2.5 cm. long, 3–4 mm. thick; seeds pendulous, enclosed in the hard endocarp and thus made to appear truncate at both ends, triangular in cross section, 1.5 mm. long, 1.5 mm. wide.

In water and moist places. Southeastern United States, Guatemala and Costa Rica, Ecuador, Peru, Brazil to Argentina.

To be expected in Panama.

16. JUSSIAEA REPENS L. var. PEPLOIDES (H.B.K.) Grisebach, Cat. Pl. Cubens., 107. 1866.

Jussiaea peploides H.B.K., Nov. Gen. et Sp. 6:97. 1823.
Ludwigia ascendens var. *peploides* Hara, Journ. Jap. Bot. 28:291. 1953.
Jussiaea polygonoides H.B.K., l.c.
Jussiaea patibilcensis H.B.K., l.c.
Jussiaea Swartziana DC., Prodr. 3:54. 1828.
Jussiaea ramulosa DC., l.c.
Ludwigia ramulosa Gomez, Anal. Hist. Nat. Madrid 23:66. 1894.
Jussiaea repens var. *ramulosa* Griseb., Cat. Pl. Cubens., 107. 1866.
Jussiaea polygonifolia Willd. ex Steud., Nomencl. ed. 2, 1:836. 1840.
Jussiaea fluitans G. Don, Gen. Syst. 2:692. 1832.
Jussiaea repens var. *minor* Mich. in Martius, Fl. Bras. XIII, pt. 2:166. 1875.
Jussiaea repens var. *californica* Wats., Bot. Calif. 1:217. 1876.
Jussiaea californica Jepson, Fl. West. Mid. Calif., 326. 1901.
Jussiaea Gomezii Goyena, Fl. Nicaraguense 1:406. 1909.

Perennial herb with creeping or floating stems, rooting freely at the nodes, often ascending at the tips, freely branched especially in terrestrial forms, essentially glabrous; roots mostly fibrous, sometimes spongy; leaves oblong to spatulate-oblong, obtuse to acute, 1–4 (–6) cm. long, 0.5–2 cm. wide, those above the water tending to be glandular-mucronate, narrowed at base into flattened or winged petioles 0.5–2.5 cm. long, entire, with ca. 7–11 principal veins on each side of the midrib, submarginal vein scarcely evident, leaf-blades usually shining above, somewhat ciliate, minutely pellucid-punctate; pedicels slender, ascending to reflexed in fruit, 1–3 cm. long; bracteoles deltoid, squamate, thickened, 0.5–1 mm. long; sepals 5, linear-lanceolate, subglabrous, 4–7 mm. long, obscurely nerved, acute; petals yellow, obovate, emarginate, 7–14 mm. long; disc flat, hairy; stamens somewhat unequal; filaments slender, 3–6 mm. long; anthers ca. 1 mm. long; style slender, 3–5 mm. long; stigma flattened, shallowly 5-lobed, 1–2.5 mm. wide; ovary subcylindric, 7–14 mm. long; fruit cylindrical, unequally 10-nerved, marked on the surface by the contained seeds, 1–2.5 cm. long, 2–2.5 mm. thick, scarcely if at all narrowed at apex, rather abruptly so at base; seeds in 1 row in each locule, pendulous, included in endocarp, oblique-truncate at ends, somewhat triangular in cross-section, 1–1.5 mm. long.

In water and on wet banks. Southwestern United States through Mexico to South America except Chile; West Indies.

To be expected in Panama.

2. LUDWIGIA L.

LUDWIGIA L., Gen. Pl., ed. 5, 55. 1754.

Isnardia L., Gen. Pl., ed. 5, 56. 1754.

Mostly perennial herbs with opposite or alternate leaves and solitary axillary flowers or, by reduction of upper leaves, terminal spikes or heads. Flowers normally 4-merous, the stamens as many as the sepals and with relatively short filaments. Petals often small or wanting; if conspicuous, usually early deciduous. Floral tube not prolonged beyond the ovary. Bracteoles lacking to quite well developed. Sepals persistent; summit of ovary truncate or flattish, or crowned with pyramidal to depressed persistent 4-lobed base of style (stylopodium); style short; stigma capitate to somewhat 4-lobed. Capsule subspheric to obpyramidal, elongate, angled or subterete, dehiscing by a terminal pore or longitudinally. Seeds many, naked with evident raphe and multiseriate in each cell, or rarely enclosed in endocarp and uniseriate. A genus of ca. 35 species of wet warm places in Old and New Worlds.

a. Petals lacking or minute; leaves petioled; floating or creeping plants..... 1. L. PALUSTRIS
aa. Petals conspicuous; leaves subsessile; plants decumbent or ascending. 2. L. VERTICILLATA

1. LUDWIGIA PALUSTRIS (L.) Elliott var. NANA Fernald & Griscom, Rhodora 37: 176. 1935.

Isnardia palustris β americana DC., Prodr. 3:61. 1828.
Ludwigia repens Forst., Cat. Pl. N. Am., 22. 1771.
Ludwigia apetala Walt., Fl. Car., 89. 1788.

Fig. 95. *Ludwigia palustris*

Ludwigia nitida Michx., Fl. Bor. Am. 1:87. 1803.
Isnardia nitida Poir. in Lam., Encycl. Suppl. 3:188. 1813.
Isnardia ascendens Hall in Eaton, Man. N. Am. Bot., ed. 7, 353. 1836.
Ludwigia palustris var. *inundata* Svenson, Torreya 35:120. 1935.

Annual or perennial, glabrous or nearly so, sometimes minutely pubescent along leaf-margins, more or less succulent, the stems mostly floating, or procumbent, 1–5 (–7) dm. long, subsimple to diffusely branched, rooting freely at nodes, angled, green or with some reddish tinge; leaves opposite, the blades lanceolate to narrow-elliptic, or broadly elliptic-ovate, mostly 0.5–1.5 cm. long, entire, shining, with 4–5 principal veins on each side of midrib, acute to acuminate at apex, usually rather gradually narrowed at base into petioles 0.5–2 cm. long; flowers subsessile; ovary usually pale with 4 longitudinal green bands extending to the summit; bracteoles scarcely evident or up to ca. 1 mm. long, on base of ovary; sepals deltoid-ovate, acute, 0.5–1 mm. long; petals apparently none; stamens

less than 1 mm. long; style plus stigma less than 1 mm. high; capsule somewhat corky, oblong-obovoid, rounded at base, truncate at apex, 2–3 mm. long, 1.4–2 mm. thick at middle; seeds oblong, straight along inconspicuous raphe, curved on other edge, 0.5–0.8 mm. long, shining brown to almost white.

In quiet water or on wet banks. From southeastern United States, West Indies, Mexico, Guatemala, and Colombia. To be expected in Panama.

2. LUDWIGIA VERTICELLATA Munz, Bull. Torrey Bot. Club 71:157. 1944.

Stems slender, subglabrous, rooting freely at the nodes, apparently somewhat fleshy, green, the branches subdecumbent to ascending, 3–15 cm. long; leaves many, crowded, in whorls of 3–4 (–6), narrowly elliptic-oblanceolate, 8–18 mm. long, 1–3 mm. wide, acute at both ends, entire to somewhat denticulate, with ca. 7 principal veins on each side of the midrib, lower leaves narrowed into a short winged petiole; flowers rather few; pedicels 1.5–3 mm. long; bracteoles scarcely evident; sepals deltoid-ovate, 2.5–4 mm. long, obtusish, 3–5-veined; petals 4–5 mm. long, ca. as wide; stamens 1.5–2.5 mm. long; stylopodium somewhat flattened, hairy; stigma almost 1 mm. wide; ovary clavate-subcylindric, 5–6 mm. long at anthesis; capsule glabrous, 7–8 mm. long, 1.5–2 mm. wide, slightly 4-angled, with median groove down each face; seeds light brown, shining, subovoid. with clearly defined raphe and ca. 0.6 mm. long.

Wet places. Southern Mexico to Panama.

PANAMÁ: Laguna de Portola, near Chepo, *Pittier 4605*.

3. OENOTHERA L.

OENOTHERA L., Gen. Pl., ed. 5, 163. 1754.

Hartmannia Spach, Hist. Nat. Vég. Phan. 4:370. 1835.
Xylopleurum Spach, l.c.
Raimannia Rose, Contr. U. S. Nat. Herb. 8:330. 1905.

Annual to perennial, caulescent or acaulescent herbs, with alternate or basal leaves. Flowers white to yellow or rose, often aging reddish or purplish, solitary in axils or in racemes or spikes. Floral tube prolonged beyond the ovary, quite deciduous. Sepals 4, reflexed in anthesis. Petals 4. Stamens 8, equal, or if unequal the epipetalous shorter; anthers mostly versatile. Stigma varying from having 4 linear lobes, to discoid or capitate. Capsule membranous to woody, straight to curved or coiled, 4-loculed, 4-valved, mostly dehiscent. Seeds many, naked. A genus of ca. 200 species mostly of temperate parts of the Americas.

a. Capsule broadest above the middle, clavate, 4-angled or -winged; seeds appearing smooth under hand-lens. (Subgenus *Hartmannia*).
  b. Petals 2–3.5 cm. long, white, aging pink; body of capsule 1–1.5 cm. long, with wings 2–3 mm. wide.... 2. OE. TETRAPTERA
  bb. Petals 0.3–1 cm. long, not white; body of capsule mostly shorter, with narrower wings.
    c. Flowers yellow or greenish, aging orange-red, the petals 3–6 mm. long; leaves subentire.... 1. OE. MULTICAULIS
    cc. Flowers rose to red-violet, aging purplish, the petals 5–10 mm. long; leaves mostly sinuate-pinnatifid to -dentate.... 3. OE. ROSEA
aa. Capsule cylindrical, subterete; petals yellow, 5–15 mm. long; seeds evenly and regularly pitted. (Subgenus *Raimannia*).... 4. OE. LACINIATA

1. OENOTHERA MULTICAULIS R. & P. var. TARQUENSIS (H.B.K.) Munz & Johnston, Contr. Gray Herb., n. ser. 75:18. 1925.

Oenothera tarquensis H.B.K., Nov. Gen. et Sp. 6:91. 1823.
Hartmannia tarquensis Spach, Nouv. Ann. Mus. Paris 4:363. 1835.
Oenothera ascendens Willd., in Spreng., Syst. 2:230. 1825.
Oenothera cuprea Schlecht., Linnaea 12:269. 1838.
Hartmannia cuprea Rose, Contr. U. S. Nat. Herb. 8:328. 1905.
Oenothera epilobiifolia H.B.K., Nov. Gen. et. Sp. 6:92. 1823.
Hartmannia epilobiifolia Spach, Nouv. Ann. Mus. Paris 4:364. 1835.

Perennial herb, sometimes suffrutescent at base, with several villous, prostrate or procumbent leafy stems 1–3 dm. long, these simple or few-branched; leaves of basal rosette broadly oblanceolate, the blades 1–5 cm. long, 0.5–2.5 cm. wide, obtuse, subglabrous, except for pubescence on margins and on veins of lower surface, gradually narrowed at base into a winged petiole of ca. same length; cauline leaves more or less villous, especially the upper, herbaceous, commonly 2–3 cm. long, usually denticulate; flowers solitary, sessile, axillary, only 1–2 in anthesis at one time, apparently diurnal; floral tube 4–8 mm. long, more or less pubescent without, pubescent within at very base, often purplish; sepals lanceolate, pubescent, 3–6 mm. long, distinct in anthesis, green with purplish tinge; petals yellow or greenish, becoming orange-red, broadly obovate, 3–6 mm. long; stamens subequal, one-half or two-thirds the length of the petals, glabrous; style exceeding stamens, pubescent at very base; stigma-lobes ovoid, ca. 1 mm. long; capsule clavate, villous, 1–2 cm. long, 0.4–0.5 cm. thick, arcuate, somewhat 4-sided and angled or winged, with prominent vein down middle of each face; seeds many, brown, asymmetrically obovoid, 0.5–0.9 mm. long, minutely cellular-pitted, but appearing smooth under ordinary hand-lens.

Dry rocky places in mountains, Mexico, Guatemala, Costa Rica, Colombia, Venezuela, and Ecuador. To be expected in higher mountains of Panama.

2. OENOTHERA TETRAPTERA Cav., Ic. 3:40. 1794.

Xylopleurum tetrapterum Raim. in Engler & Prantl, Die nat. Pflanzenfam. III, 7:214. 1893.
Hartmannia tetraptera Small, Bull. Torrey Bot. Club 23:181. 1896.
Oenothera tetraptera var. *immutabilis* Lévl., Mon. Onoth., 122. 1902.
Hartmannia macrantha Spach, Nouv. Ann. Mus. Paris 4:363. 1835.
Oenothera latiflora Sér. in DC., Prodr. 3:50. 1828.
Hartmannia latiflora Rose, Contr. U. S. Nat. Herb. 8:329. 1905.

Perennial herb, sometimes suffrutescent, decumbent to ascending, with few simple or branched stems 1.5–5 dm. long, more or less strigulose and also with long spreading hairs; basal leaves oblanceolate or broader, 3–10 cm. long, 1–3 cm. wide, sinuate-pinnatifid, with several ovate-oblong lateral lobes and a larger terminal one, subglabrous to villous, with well developed petioles; cauline leaves reduced, 2–5 cm. long, mostly sinuate-pinnatifid; flowers vespertine, in axils of uppermost reduced leaves; floral tube commonly hirsute as well as strigose, ca. 1 cm. long, puberulent within at base; sepals commonly reddish, 2–3.5 cm. long, coherent in anthesis, at least in pairs, with minute free tips in bud; petals white, rose in age, 2–3.5 cm. long, broadly obovate; stamens subequal, one-half to two-

thirds the length of the petals; filaments 1–1.5 cm. long; capsule proper obovoid, 1–1.5 cm. long, 0.6–0.8 cm. thick, hirsute, especially on veins and wings, the latter 2–3 mm. wide, capsule narrowed into a basal ribbed hollow sterile part 0.5–2.5 cm. long; seed light brown, obovoid, ca. 1.3 mm. long.

Ranging from Mexico to Costa Rica and in Colombia and Venezuela. To be expected in Panama in the mountains.

3. Oenothera rosea Ait., Hort. Kew., ed. 1, 2:3. 1789.

Hartmannia rosea G. Don in Sweet, Hort. Brit., ed. 3, 236. 1839.
Xylopleurum roseum Raim. in Engler & Prantl, Die nat. Pflanzenfam. III, 7:214. 1893.
Oenothera rubra Cav., Icones 4:68, *t. 400*. 1797.
Oenothera purpurea Lam., Encycl. 4:554. 1797.
Oenothera virgata R. & P., Fl. Peruv. 3:79, *t. 315*. 1802.
Hartmannia virgata Spach, Nouv. Ann. Mus. Paris 4:363. 1835.
Hartmannia gauroides Spach, l.c.
Hartmannia affinis Spach, Ann. Sci. Nat., ser. 2, 4:167. 1835.
Oenothera psycrophila Ball, Journ. Linn. Soc. 22:38. 1885.
Oenothera rosea var. *parvifolia* Coult., Contr. U. S. Nat. Herb. 2:116. 1891.
Hartmannia rosea var. *parvifolia* Small, Bull. Torrey Bot. Club 23:181. 1896.
Godetia Heucki Phil., Anal. Univ. Chil. 84:743. 1893.
Gaura epilobia Moç. & Sessé ex Sér. in DC., Prodr. 3:45. 1828.

Perennial, flowering the first year, with several erect or ascending, slender, simple or branched stems from a somewhat woody caudex and 1–5 dm. long, or shrubby and becoming 10 dm. tall, more or less strigulose throughout, sometimes with spreading hair on the lower stems; leaves usually not crowded, the basal oblanceolate to narrowly obovate, subentire to coarsely sinuate-dentate or -pinnatifid, 2–5 cm. long, obtuse, narrowed into slender petioles 1–2 cm. long; cauline leaves gradually reduced up the stem, mostly oblong-ovate, 1.5–3 cm. long; uppermost reduced to bracts in axils of which are borne the flowers in slender racemes; floral tube 4–8 mm. long, slender, strigulose-canescent without, somewhat puberulent within; sepals 5–8 mm. long, with free tips ca. 1 mm. long, and commonly coherent in anthesis; petals rose to red-violet, broadly obovate, 5–10 mm. long; stamens subequal, almost as long as petals; filaments slender 4–6 mm. long; anthers 2.5–4 mm. long; capsule proper obovoid, 8–10 mm. long, 3–4 mm. thick, the 4 angles somewhat winged, scarcely 1 mm. wide, the midrib of each valve strongly developed, base of capsule passing into a hollow and ribbed part 5–20 mm. long; seeds oblong-obovoid, asymmetrical, brown, ca. 0.6 mm. long.

Common in damp places from southern United States to Peru and Bolivia. To be expected in Panama.

4. Oenothera laciniata Hill var. pubescens (Willd.) Munz, Am. Journ. Bot. 22:656. 1935.

Oenothera pubescens Willd. ex Spreng., Syst. 2:229. 1825.
Oenothera Steubelii Hieron., Engler Bot. Jahrb. 21:327. 1895.
Oenothera nyctaginifolia Small, Bull. Torrey Bot. Club 27:278. 1900.
Raimannia confusa Rose, Contr. U. S. Nat. Herb. 8:330. 1905.
Raimannia colimae Rose, l.c.
Anogra amplexicaulis Woot. & Standl., Contr. U. S. Nat Herb. 16:150. 1905.

Fig. 96 *Oenothera laciniata*

Perennial, from simple and erect and 1–2 dm. high to branched above and 6–8 dm. high, cinereous-puberulent and somewhat villous; leaves oblanceolate to oblong-lanceolate, mostly sinnuate-pinnatifid, 2–8 cm. long, the lower petioled, the upper gradually reduced, more or less sessile; flowers solitary in upper axils, the stem tip and buds erect or nodding; floral tube 1.5–3 cm. long, slightly pubescent within near base; sepals lance-linear, 6–10 mm. long, the tips not over 0.5 mm. long and scarcely if at all corniculate or free; petals yellow, 5–15 mm. long, broadly obovate; filaments slightly flattened, almost as long as petals; style glabrous; stigma lobes linear, 2–6 mm. long; capsule cylindrical, usually somewhat arcuate, divaricate, 1–3 cm. long, 2–3 mm. thick, sessile; seeds ca. 1 mm. long, 0.6 mm. thick, brownish, evenly and regularly pitted.

Damp places. Southwestern United States to Ecuador. To be expected in Panama, although no material seen from there.

4. LOPEZIA Cav.

Lopezia Cav., Ic. 1:12, *t. 18*. 1791.

Herbs or shrubs, mostly freely branched. Leaves petioled, alternate, or the lower opposite, simple. Flowers solitary, small, pedicelled, in upper axils of sometimes much reduced leaves. Floral tube inconspicuous. Sepals 4, mostly red, narrow. Petals 4, dissimilar, white to rose, the 2 upper unguiculate, with none, one, or two glands at apex of claw; the 2 lower clawed and curved upward, glandless. Stamens 2, adnate to the style and connate with each other at the base, the posterior fertile, the anterior sterile, petaloid. Ovary 4-loculed; style short, filiform, with slightly enlarged and barely lobed stigma; ovules multiseriate, many. Capsule globose to clavate, coriaceous, 4-loculed and -valved. Seeds many, obovoid, granulate. A genus of about 14 species; Mexico to Panama.

1. Lopezia paniculata Seem. Bot. Voy. Herald 120. 1853.

Branched shrub to ca. 1 m. high, glabrous to hirsute-pubescent, not glandular; leaves alternate or opposite, lance-ovate to ovate, 1–5 cm. long, entire to slightly dentate; flowers in quite dense racemes, irregular, 7–10 mm. across; pedicels slender, spreading, glabrous, 7–18 mm. long; sepals red, linear, 4–5 mm. long, 1–1.5 mm. broad; upper petals mostly pink, 4–5 mm. long, with narrow claw comprising ca. two-thirds the total length and bearing 2 glands at its apex, the blades spatulate, winged above the glands; lower petals 4–5 mm. long, with narrow claw and roundish blade; sterile stamen 4–5 mm. long, pinkish or somewhat purple, with obovate blade; fertile stamen with filament not winged; style ca. 3–4 mm. long; stigma flat, round; capsule spherical, 2.5–3 mm. in diam.; seeds brown, covered with corky tubercles and ca. 1 mm. long.

Rather dry places at 3000 to 5000 ft., Guatemala to Panama.

Chiriquí: near El Volcán, Río Chiriquí Viejo Valley, *Gene White 30*; upper Río Chiriquí Viejo, *Gene White 43, Peggy White 323*; Llanos del Volcán, *Allen 987* and *1553*; Bajo Mono, Boquete District, *M. E. Davidson 493*; El Boquete, *Killip 3505, Pittier 2890, Bro. Maurice 749*.

Fig. 97. *Lopezia paniculata*

5. FUCHSIA L.

FUCHSIA L., Gen. Pl., ed. 5, 126. 1754.

Schufia Spach, Ann. Sci. Nat., ser. 2, 4:177. 1835.
Encliandra Zucc., Abh. Akad. Muenchen 2:335. 1837.

Shrubs to trees with simple, alternate, opposite or whorled leaves having small usually deciduous stipules. Flowers solitary in axils of ordinary leaves or racemose or paniculate, generally showy, pendulous and long-pedicelled, sometimes erect; mostly perfect, sometimes imperfect. Floral tube prolonged beyond the ovary, usually colored, deciduous in fruit. Sepals 4, usually colored, deciduous after anthesis. Petals 4, or minute or none, convolute or spreading, deciduous after anthesis. Stamens 8, usually unequal, the episepalous exceding the epipetalous; filaments more or less filiform; anthers linear to oblong. Ovary 4-loculed; style elongate; stigma capitate or clavate, subentire to 4-lobed. Fruit a berry. About 100 species, Mexico to Patagonia; New Zealand, Tahiti.

a. Floral tube several times longer than the sepals, 5–6 cm. long..... 1. F. BOLIVIANA
aa. Floral tube not more than 1 cm. long.
  b. The floral tube as long as the sepals; flowers erect, in terminal cymose panicles..... 2. F. ARBORESCENS
  bb. The floral tube twice as long as sepals; flowers not erect, solitary in leaf-axils..... 3. F. HEMSLEYANA

1. FUCHSIA BOLIVIANA Carr. var. LUXURIANS Johnston, Contr. Gray Herb., n. ser. 75:38. 1925.

Fuchsia cuspidata Fawcett & Rendle, Journ. Bot. 64:105, 159. 1926.

Bushy shrub or small tree to 6 m. high, with rather open branching, the branchlets spreading or pendulous, mostly 2–4 mm. thick, terete to angled, soft-pilose to -pubescent; leaves opposite, sometimes alternate or in 3's, elliptic to oblong-lanceolate or -ovate, obtuse to rounded at base, acute to acuminate at apex, usually somewhat denticulate, soft-pubescent, with ca. 12–14 principal lateral veins on each side of the midrib, the blades 5–15 (–20) cm. long, 3–6 (–10) cm. wide; petioles 2–4 cm. long; stipules sublunate-lanceolate, scarcely 1 mm. long, deciduous; flowers few to many, in terminal drooping pubescent corymbs or panicles which elongate in fruit; bracts 7–25 mm. long, usually lanceolate and reflexed; pedicels 5–15 mm. long; floral tube tubular, 5–6 cm. long, usually dark red, slightly enlarged at base, then 1.5–2 mm. wide and gradually ampliate until 3.5–7 mm. wide at apex, more or less pubescent without and within; sepals red, lanceolate, acuminate, 17–20 mm. long, spreading-reflexed in anthesis; petals red, oblong, 9–13 mm. long, acute; stamens glabrous, the filaments reddish, anthers light in color, 2–3 mm. long; style slender, scarcely reaching the tips of the sepals; stigma subglobose, slightly lobed, 1–2 mm. thick; berry oblong-ellipsoid, 1–2 cm. long, 4–6 mm. thick, pubescent.

A montane plant known from Jamaica, Guatemala, El Salvador, Colombia and Venezuela. To be expected in higher mountains in Panama.

2. FUCHSIA ARBORESCENS Sims, Curtis Bot. Mag., *t. 2620.* 1826.

Schufia arborescens Spach, Ann. Sci. Nat., ser. 2, 4:177. 1835.

Fuchsia hamellioides Moçiño & Sessé ex G. Don, Gen. Syst. 2:677. 1832, in synon.
Fuchsia syringaeflora Carr., Rev. Hortic., 1873:311. 1873.
Fuchsia arborea Sessé & Moçiño, Pl. N. Hispan., ed. 1, 58. 1887–1890.
Fuchsia arborescens var. (?) *megalantha* J. Donn. Smith, Bot. Gaz. 18:2. 1893.
Fuchsia Liebmanni Lévl., Bull. Géogr. Bot. 22:24. 1912.

Low shrub to tree 20 m. tall, sometimes epiphytic, glabrous or nearly so; branchlets, petioles and veins sometimes tinged with red; leaves opposite or in 3's, oblong-oblanceolate to -elliptic, acute or acuminate at both ends, paler beneath than above, entire to serrulate, the blades 3–20 cm. long, with 9–13 principal veins on each side of midrib; flowers many, crowded in corymbose panicles 5–25 cm. long and equally wide, the lower branches of the inflorescence with few reduced leaves, the upper floriferous ones with much reduced deciduous subulate bracts; pedicels reddish, slender, erect, 5–20 mm. long; floral tube tubular to funnelform, 4.5–8 mm. long, 2–3 mm. wide at summit; sepals reddish to wine-purple, linear to lance-oblong, 4.5–7 mm. long, spreading-reflexed at anthesis; petals lavender to lilac, lance-ovate, spreading, two-thirds as long as sepals; epi-sepalous stamens exceeding sepals, epipetalous somewhat shorter; stigma purplish, conic, ca. 0.5 mm. long; berry purplish, covered with blue bloom, subglobose, 7–10 mm. thick.

At elevations of 1000–2600 m., from Mexico to Panama.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, *Allen 4965*. CHIRIQUÍ: Volcán de Chiriquí, *M. E. Davidson 955A*; near Casita Alta, Volcán de Chiriquí *Woodson, Allen & Seibert 840* and *797*; near Bajo Chorro, *Woodson & Schery 700*; valley of upper Río Chiriquí Viejo near Monte Lirio, *Seibert 246*; El Boquete, *Pittier 2974*.

Minor variants from the typical form are: forma TENUIS Munz, Proc. Calif. Acad. Sci., ser. IV, 25:86. 1943, with the floral tube 5–6 mm. long, 1 mm. wide; sepals 5–6 mm. long, 1–1.5 mm. wide. Material seen from Panama:

CHIRIQUÍ: near Casita Alta, Volcán de Chiriquí, *Woodson, Allen & Seibert 911*; El Boquete, *Maxon 5015*; Bajo Mono, Robalo Trail, *Allen 4778*; near Cerro Punta, *Allen 3505*. Forma PARVA Munz. l. c. [*Fuchsia paniculata* Lindl., Gard. Chron. 1856:301. 1856.] with floral tube funnelform, 3–4 mm. long, 1.5 mm. wide; sepals 3–4 mm. long, 1 mm. wide. Material seen from Panama:

CHIRIQUÍ: trail from Bambito to Cerro Punta, *Allen 310*; Río Chiriquí Viejo Valley between El Volcán and Cerro Punto, *Gene White 4*; near El Volcán, *Peggy White 179*; near "New Switzerland," central valley of Río Chiriquí Viejo, *Allen 1351*.

3. FUCHSIA HEMSLEYANA Woodson & Seibert, Ann. Mo. Bot. Gard. 24:194. 1937.

Fuchsia pulchella Woodson & Seibert, op. cit., 195–196. 1937.

Shrub 1–3 m. tall, rather openly branched, the ultimate branchlets slender, minutely pubescent, sometimes strigulose; leaves mostly opposite, rather crowded, subcoriaceous, rhomboid-elliptic to -obovate, cuneate at base, acute to obtusish at apex, serrulate to sinuate-dentate, paler beneath than above, subglabrous except on upper surface of midrib and along margin, the blades 7–15 (–25) mm. long, 4–8 (–12) mm. wide; petioles sparsely puberulent, 3–8 (–12) mm. long; flowers solitary, axillary, perfect or pistillate; pedicels filiform, 4–8 mm. long; floral tube

Fig. 98. *Fuchsia hemsleyana*

rose, tubular, constricted above ovary, 5–8 mm. long, 1–2 mm. wide at summit, glabrous to puberulent; sepals deltoid-lanceolate, rose, spreading-reflexed at anthesis, 3.5–4 mm. long, apiculate; petals rose or with purplish tinge, oblong-obovate, 2.5–4 mm. long, rounded at apex; stamens usually included; style 8–10 mm. long; stigma deeply 4-lobed, exserted, 1 mm. long; fruit subglobose, black-purple 4–5 mm. thick.

At about 1300–3500 m., mountains of Costa Rica and Panama.

CHIRIQUÍ: near Casita Alta, Volcán de Chiriquí, *Woodson, Allen & Seibert 811* and *873*; Cuca Peak, Volcán de Chiriquí, *Terry 1331*; Cerro Copete, *Allen 4897*; Finca Lerida, *Woodson & Schery 217*; Bajo Chorro, Boquete district, *M. E. Davidson 319, Woodson & Schery 637*; between El Volcán and Cerro Punta, *Gene White 2*; trail from Paso Ancho to Monte Lirio, *Allen 1497;* near Monte Lirio, upper Río Chiriquí Viejo, *Seibert 162, 182;* Cerro Pando, upper Río Chiriquí Viejo, *Peggy White 1*; Potrero Muleto to summit, Volcán de Chiriquí, *Woodson & Schery 417, 387, Davidson 876*; Cuesta de Cerro Quemado, east slope of Volcán Chiriquí, *Pittier 3114*.

HALORAGIDACEAE

1. GUNNERA L.

GUNNERA L. Mant. 1:16. 1767.

Perpensum Burm. f. Fl. Cap. Prodr. 30 (err. typ. 26). 1768.
Panke Molina, Sagg. Chile 143. 1782.
Dysemone Soland. ex Forst. f. in Comment. Goetting. 9:45. 1789.
Misandra Comm. ex Juss. Gen. 305. 1789.
Milligania Hook. f. in Hook. Icon. *t. 299*. 1840.
Misandropsis Oerst. in Kjoebenhavn Vid. Meddel. 192. 1857.
Pankea Oerst. loc. cit. 1857, var. typ.
Gunneropsis Oerst. loc. cit. 193. 1857.
Pseudo-Gunnera Oerst. loc. cit. 1857.

Perennial scapose herbs, our species very massive, with condensed succulent suberect or rhizomatous stems. Leaves proportionally large, long-petiolate, the blade palmately veined, broadly subreniform-cordate to suborbicular, variously lobed and incised, the petiole subtended by more or less conspicuous intra-axillary or ochreate stipules. Inflorescence scapose, paniculate, racemose or capituliform, bearing numerous minute sessile, ebracteate, hermaphrodite or unisexual epigynous flowers. Calyx lobes 2, minute, persistent but seldom accrescent. Petals 2 or 0, minute when present, deciduous. Stamens 2 or rarely 1, the anther basifixed, 2-celled, longitudinally dehiscent. Ovary inferior, 1-celled, containing a single pendulous ovule; stigma lobes 2 or rarely 1, sessile, filamentous, densely papillose. Fruit a minute 1-seeded drupe.

About 25 species chiefly of the high mountains of the western American cordillera from Chiapas to Tierra del Fuego, but with 9 described species in New Zealand and Tasmania and scattering species in eastern Brazil (Rio de Janeiro), Indonesia, Philippines, Hawaii, South Africa, Madagascar, and the high mountains of East Africa: a most puzzling and interesting distribution.

Because of the huge size of most species, *Gunnera* is a poor representative for Haloragidaceae, the other genera of which are rather small aquatic or subaquatic

Fig. 99. *Gunnera insignis*

herbs such as the Parrot Feather (*Myriophyllum brasiliense* Camb.), a common aquarium plant in the north. The watery stems and petioles of G. *insignis* are inhabited by colonies of an endophytic alga, *Nostoc gunnerae*, which are seen easily if the plants are gashed with a machete.

1. GUNNERA INSIGNIS (Oerst.) A. DC. in DC. Prodr. 16^2:597. 1868.

Pankea insignis Oerst. in Kjoebenhavn Vidensk. Meddel. 189. 1857.
Gunneria wendlandii Reinke (in Morphol. Abh. 111. 1873, nom. nud.), ex Schindl. in Engl. Pflanzenreich IV^{225}:127. 1905.

Gigantic subacaulescent terrestrial herbs, the stem very succulent and up to about 3 dm. long and 1 dm. in diameter. Leaves very large, the elongate petioles subtended by numerous bright red, deeply laciniate, obovate-cuneate stipules up to 12 cm. long and 5 cm. broad; blade broadly subreniform-ovate to suborbicular, deeply cordate, with 7–9 very broad obscurely dichotomous, crenulate-serrate lobes, the veins ending in conspicuous marginal hydathodes, up to about 2 m. long and broad, minutely scabrous and somewhat bullate above, densely and minutely ferruginous-puberulent particularly on the venation beneath; petiole very stout, 1.5–2.0 m. long, up to 8 cm. broad at the base, minutely ferruginous-puberulent and more or less conspicuously muricate. Inflorescence spicate-paniculate, once-compound, the rachis axillary, up to about 1 m. long, minutely ferruginous-puberulent; flowering branches 1–3 dm. long, bearing very numerous small sessile ebracteolate flowers. Flowers apparently all hermaphrodite, apetalous, proterandrous; ovary broadly ellipsoid, about 1 mm. long, glabrous, the 2 broadly triangular calyx-lobes about one-quarter as long; anthers broadly oval, somewhat more than 1 mm. long, much longer than the filament; stigma lobes about as long as the ovary. Drupes broadly ovoid, about 1.5 mm. long, white.

Costa Rica and Panama, at high elevations (1,000–2,500 m.).

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, *Allen 5004*. CHIRIQUÍ: Bajo Mona, western slopes of Cerro Horqueta, *Allen 4799*; trail from Paso Ancho to Monte Lirio, upper valley of Río Chiriquí Viejo. *Allen 1501*; near El Volcán, *P. White 185*.

This magnificent species is one of the unforgettable sights seen by an observant climber in the high mountains of Chiriquí and central Costa Rica. The plants frequent the steep sides of moist ravines and quebradas where the giant leaves may be expanded to the sunlight.

ARALIACEAE

By LORIN I. NEVLING Jr.

In Panama, perennial herbs, shrubs or trees, sometimes scandent epiphytes when juvenile, rarely epiphytic at maturity. Leaves alternate, simple to pinnately or palmately compound or decompound; stipules adnate to the petiole, sometimes hardly distinct, sometimes connate and produced into a coriaceous ligulate sheath, sometimes absent. Flowers in umbels or heads, these disposed in solitary or

compound inflorescences; pedicels continuous with or articulated with the calyx, sometimes swollen at the apex into minute cupules. Flowers epigynous, bisexual, polygamous or dioecious, actinomorphic, usually small; calyx tube obconic, cupuliform, or short-cylindric; petals 5–10, broadest at the base, deciduous at maturity, free or connate and calyptrate, valvate or narrowly imbricate; stamens usually as many as the petals and alternate with them (rarely more numerous), inserted on a disc within the calyx-limb, the filaments filiform or ligulate, the anthers oblong, ovate or subglobose, dorsally affixed, the locules 2, longitudinally dehiscent; disc epigynous, carnose and short-conic or annular; pistil 1, the ovary inferior, in our species 2- to 12-locular, the styles as many as the locules, sometimes distinct and at length recurved with the stigmas terminal or on the interior surfaces, sometimes completely connate into a carnose column, rarely suppressed with the stigmas sessile on the disc, the ovules solitary, pendulous from the apex of each locule, anatropous with a ventral raphe; fruit baccate or drupaceous, the exocarp usually carnose, the endocarp divided into distinct crustaceous, cartilaginous or membranous pyrenes, or hardly distinct from the exocarp; seeds solitary in pyrenes, laterally compressed, triquetrous in cross section, with copious endosperm and a small embryo near the hilum.

A family of about 65 genera with more than 800 species.

This treatment is based on a study of the North American Araliaceae by Albert C. Smith whose very capable and helpful work was published in North American Flora 28B:3–41. 1944.

The Araliaceae are represented in Panama by five indigenous genera and a single introduced ornamental species of a sixth. The introduction, *Nothopanax guilyfolyei* (Cogn. & Marche) Merr., is easily recognized by its once-pinnately compound leaves, the leaflets of which are conspicuously and coarsely serrate.

a. Leaves 3- or 4-pinnate, the leaflet margins mucronate-serrulate..... 1. SCIADODENDRON
aa. Leaves simple or palmately compound.
  b. Flowers in umbels (in heads in *Dendropanax sessiliflorus* with bisexual flowers and some species of *Schefflera* with connate petals, compound leaves and conspicuously ligulate petiole), bisexual or polygamo-monoecious.
    c. Styles and locules 2, rarely 3; petioles dilated at the base into a coriaceous ligulate sheath..... 2. DIDYMOPANAX
    cc. Styles and locules 5–9, usually 5.
      d. Leaves simple, the petiole without an obvious ligule; petals free. 3. DENDROPANAX
      dd. Leaves compound (simple only in *S. epiphytica* among our species), the petiole with a conspicuous coriaceous ligule; petals usually connate and calyptrate..... 4. SCHEFFLERA
  bb. Flowers in heads, polygamo-dioecious (rarely polygamo-monoecious); petioles without an obvious ligule..... 5. OREOPANAX

1. SCIADODENDRON Griseb.

SCIADODENDRON Griseb. in Bonplandia 6:7. 1858.

Shrubs or trees, glabrous throughout. Leaves 3- or 4-pinnate, the leaflets petiolulate; petioles subterete, swollen and somewhat sheathing at the base, seemingly estipulate. Inflorescences terminal on short branches, paniculate, the primary peduncle and rhachis stout, short, woody, the secondary peduncles and rhachises few, the floriferous peduncles bracteate, in several indefinite whorls; pedicels

Fig. 100. *Sciadodendron excelsum*

bracteolate, inconspicuously articulated with the calyx tube. Flowers in umbels, bisexual; calyx cupuliform, the margin membranaceous, undulate or obscurely 4- to 7-dentate, the base fluted immediately above the attachment of the pedicel; petals 9–10, connate at their bases, imbricate in bud; stamens 9–12; disc fleshy; styles 9–12, connate below, forming a stout cylindrical column, free above, the stigmas in a ring at the apex of the column, the locules as many as the styles. Fruit subglobose, conspicuously costate.

A monotypic genus.

1. SCIADODENDRON EXCELSUM Griseb. in Bonplandia 6:7. 1858.

Reynoldsia americana Donn. Sm. in Bot. Gaz. 49:455. 1910.

Shrubs or trees to 20 m. tall, the bark corky, the branches few, the foliage and inflorescences forming an apical crown, the flowers usually maturing after the leaves have fallen. Leaves to 2 m. long, the leaflets membranaceous, ovate to elliptic, 3–8 (–15) cm. long, 1–5 (–7) cm. broad, long-acuminate at the apex, acute to truncate at the base, the principal veins raised on both surfaces, the primary lateral veins few, arcuate-ascending; petioles to 60 cm. long, to 1 cm. in diameter, the petiolules to 7 mm. long. Inflorescences with secondary peduncles 1.5–5.0 cm. long, the secondary rhachises 3–7 cm. long, the floriferous peduncles 4–10 cm. long, subtended by a bract to 6 mm. long, with a pair of often inconspicuous ovate bracts at the base; pedicels 3–10 cm. long, subtended by bracteoles to 3 mm. long. Flowers 15–35 per umbel; calyx tube 1–2 mm. long, about 3–4 mm. in diameter; petals oblong-deltoid, 1.5–3.5 mm. long, 1.0–1.5 mm. broad, inflexed apically, carnose, white; filaments 3–4 mm. long, the anthers oblong, 2–3 mm. long, to 1 mm. broad. Fruit 6–7 mm. in diameter, the apex flattened, the calyx-limb and column persistent.

Guatemala southwards into Colombia; Haiti. Known as *hobo lagarto* in Panama.

PANAMÁ: Chepo, *Kluge 50*; Río Las Lajas, alt. ca. 20 m., *Allen 1604*.

2. DIDYMOPANAX Dec. & Planch.

DIDYMOPANAX Dec. & Planch. in Rev. Hortic. ser. IV. 3:109. 1854.

Shrubs or trees, glabrous or variously pubescent. Leaves palmately compound (in our species) or simple; petioles dilated at the base into a coriaceous ligulate sheath. Inflorescences compound-paniculate or compound-umbellate, terminal or lateral, the branchlets subtended by coriaceous bracts, the umbels numerous; pedicels subtended by minute bracteoles, continuous with the calyx. Flowers bisexual, 5-merous; calyx cupuliform, the limb short, denticulate; petals usually thin-carnose, acute at the apex, thickened and slightly cucullate distally, greenish-white or brownish, valvate in bud; stamens inflexed in bud, the anthers loosely coherent or separate; disc raised and undulate at the margin; styles 2, rarely 3, carnose, distinct to the base or partially connate; ovary thick-walled, the locules and ovules the same number as the styles. Fruit laterally compressed, longitudinally bisulcate, surmounted by the persistent calyx-limb and the stylar column or recurved styles, the seeds 2, rarely 3.

a. Blades of the leaflets more than 2½ times as long as the petiolules, oblong or oblong-oblanceolate, more than twice as long as broad..... 1. D. MOROTOTONI
aa. Blades of the leaflets up to twice as long as the petiolules, broadly ovate, less than twice as long as broad..... 2. D. PITTIERI

1. DIDYMOPANAX MOROTOTONI (Aubl.) Dec. & Planch. in Rev. Hortic. ser. IV. 3:109. 1854.

Panax Morototoni Aubl. Pl. Guian. 949. 1775
Aralia micans Humb. & Bonpl. in Syst. Veg. 6:701. 1820.
Panax speciosum Eggers, Fl. St. Croix 59. 1879, not Willd.
Didymopanax micans (Humb. & Bonpl.) Krug & Urb. in Urb. Symb. Ant. 1:204. 1899.

Fig. 101. *Didymopanax Morototoni*

Trees to 25 m. tall, the foliage and inflorescences often clustered at the summit. Leaves palmately compound; leaflets 7–12, the blades coriaceous, more than 2½ times as long as the petiolules, more than twice as long as broad, oblong or oblong-oblanceolate, 8–45 cm. long, 3–19 cm. broad, long-acuminate at the apex, rounded to subcordate at the base, entire, glabrous above, ferrugineous-sericeous below, the costa and primary lateral veins prominent; petioles to 1 m. long, terete, the ligule to 1 cm. long, the petiolules 3–14 cm. long, puberulent or glabrous. Inflorescence with umbels racemosely arranged in a terminal compound-panicle, densely canescent-sericeous throughout, the primary peduncle 3–15 cm. long, the primary rhachis 6–30 cm. long, the secondary peduncles 7–15, 1–3 cm. long, the secondary rhachises 2–12 cm. long, subtended by an oblong bract to 5 mm. long, the floriferous peduncles 1.0–2.5 cm. long, subtended by a small bract, 2–4 times bracteate along its length; pedicels 2–5 mm. long. Flowers 7–15 per umbel; calyx 1.0–1.5 mm. long, the lobes extremely short; petals oblong, 1.5–2.5 mm. long, 1.0–1.5 mm. broad, glabrous within, the midrib prominent; filaments about 0.75 mm. long, the anthers oblong, 1.0–1.5 mm. long, about 0.75 mm. broad; disc pubescent; styles 2, free, 0.5–1.0 mm. long, erect, spreading in fruit. Fruit transversely oblong, 4–6 mm. long, 7–10 mm. broad, coriaceous.

Southern Mexico to South America; Antilles.

CANAL ZONE: Las Cruces Trail, *Harvey 5049*; Barro Colorado Island, *Shattuck 669*, *Wetmore & Abbe III*, *Aviles 27, 53*; without precise locality, *Harvey 5115*. PANAMÁ: vicinity of Pacora, alt. ca. 35 m., *Allen 1114*. VERAGUAS: trail between Cañazas and the foot of the Cordillera Central, headwaters of Río Cañazas, 300–600 m., *Allen 150*.

2. DIDYMOPANAX PITTIERI Marchal, in Bull. Soc. Roy. Bot. 30[1]:280. 1891.

Trees to 20 m. tall, glabrous throughout, the branchlets stout, terete. Leaves palmately compound; leaflets 5–9, the blades thin-coriaceous, up to twice as long as the petiolules, less than twice as long as broad, broadly ovate, 4–14 cm. long, 3.5–9.0 cm. broad, acuminate at the apex, truncate to rounded at the base, thickened and undulate, the costa often prominent, the primary lateral veins spreading, raised on both surfaces; petioles 10–35 cm. long, the ligule 1.5–3.0 cm. long, the petiolules 3–10 cm. long, striate. Inflorescences with umbels racemosely arranged in a terminal panicle, the primary peduncle and rhachis short, stout, the secondary peduncles and rhachises few, 10–35 cm. long, the floriferous peduncles 1.5–3.0 cm. long, subtended by a bract 3–16 mm. long; pedicels 3–6 cm. long. Flowers 7–20 per umbel; calyx obconic, about 1 mm. long, teeth apiculate; petals deltoid-ovate, about 2 mm. long, 1.25 mm. broad at the base, calyptrate; filaments very short, the anthers approximately 1 mm. long, 0.75 mm. broad; styles 2 or 3, apically free. Fruit subglobose, 2.5–4.0 mm. in diameter, the stigmas slightly divaricate.

Costa Rica and Panama.

CHIRIQUÍ: humid forest of Cuesta de Las Palmas, southern slope of Cerro de la Horqueta, alt. 1700–2100 m., *Pittier 3212*.

3. DENDROPANAX Dec. & Planch.

DENDROPANAX Dec. & Planch. in Rev. Hortic. ser. IV. 3:107. 1854.

Gilibertia R. & P. Fl. Per. Prodr. 50. 1794, not J. F. Gmel.
Wangenheimia Dietr. in Lex. 10:536. 1810, not Moench.
Ginannia Dietr. in Lex. Nachtr. 3:483. 1817, not Scop.
Gilibertia subgen. *Melopanax* Marchal, in Bull. Acad. Belg. II. 47:77. 1879.

Shrubs or trees, our species generally glabrous throughout. Leaves simple, the juvenile blades occasionally lobed, the mature blades usually entire; apparently estipulate. Inflorescences with 2–20 umbels (rarely heads) racemosely or umbellately arranged in a single terminal or axillary umbel, the floriferous peduncles subtended by small bracts, sometimes bracteate and articulate above the base, swollen distally into an often carnose receptacle; pedicels continuous with the calyx, bracteate at the base. Flowers bisexual or polygamo-monoecious, 5- to 9-merous; calyx obconic or cupuliform, the limb short, usually denticulate; petals free, usually carnose and greenish-white, subacute and slightly cucullate at the apex, valvate; stamens twice as many as the petals, inflexed in bud, the anthers with loosely coherent thecae; disc short-conic, confluent with the styles; style connate into a short column or essentially free, the ovary thick-walled, the locules and ovules 5–9. Fruit subglobose or ellipsoid, sulcate, surmounted by the persistent short calyx-limbs and stylar column or styles, the seeds usually as many as the locules.

a. Umbels 3–20 per inflorescence, racemosely or umbellately arranged.
  b. Mature leaf-blades entire, undulate, remotely crenate-denticulate or serrate; primary peduncle plus rhachis 1–10 cm. long; calyx not broader than long.
    c. Inflorescence usually terminal; peduncles striate or smooth, without horizontal fissures, not (or rarely) jointed, the bracts (if present) rarely connate.
      d. Leaf-blades entire, undulate or remotely crenate, obtusely acuminate or cuspidate at the apex (the acumen rarely slender and then scarcely exceeding 15 mm. in length)..... 1. D. ARBOREUS
      dd. Leaf-blades remotely serrate with linear teeth 1–4 mm. long, slenderly acuminate at the apex (the acumen 15–25 mm. long). 2. D. STENODONTUS
    cc. Inflorescence terminal or lateral; peduncles rugose, often marked with short transverse fissures, uniformly articulate, the bracts usually connate into a small coriaceous cupule.
      e. Flowers pedicellate; leaf-blades entire or undulate..... 3. D. GONATOPODUS
      ee. Flowers sessile; leaf-blades undulate to serrate..... 4. D. SESSILIFLORUS
  bb. Mature leaf-blades entire or deeply 3-lobed, irregularly sinuate-serrate; primary peduncle plus rhachis 0.5–1.3 cm. long; calyx somewhat broader than long.
    f. Flowers 6–15 per umbel; primary peduncle plus rhachis 0.5–1.3 cm. long, the floriferous peduncles about 6 per inflorescence; pedicels glabrous..... 5. D. PRAESTANS
    ff. Flowers about 50 per umbel; primary peduncle plus rhachis less than 1 cm. long, the floriferous peduncles about 12 per inflorescence; pedicels ferrugineous-puberulent..... 6. D. ALBERTI-SMITHII
a. Umbel solitary (rarely with one or two smaller inconspicuous secondary umbels).
  g. Floriferous peduncle 0.5–2.5 cm. long; pedicel 3–15 mm. long..... 7. D. QUERCETI
  gg. Floriferous peduncle at least 3 cm. long; pedicel 25–35 mm. long. 8. D. DARIENENSIS

1. DENDROPANAX ARBOREUS (L.) Dec. & Planch. in Rev. Hortic. ser. IV. 3:107. 1854.

Aralia arborea L. Syst. Nat. ed. 10. 967. 1759.
Hedera arborea (L.) Sw. Fl. Ind. Occ. 1:518. 1797.
Hedera alaris Schlecht. in Linnaea 9:605. 1834.

Dendropanax alare Dec. & Planch. in Rev. Hortic. ser. IV. 3:107. 1854.
Sciadophyllum jacquini Griseb. Fl. Br. W. Ind. 306. 1860.
Dendropanax juergenseni Seem. in Journ. Bot. 2:301. 1864.
Sciandophyllum samydifolium Wr. ex Griseb. Cat. Pl. Cub. 117. 1866.
Dendropanax samydifolium (Wr. ex Griseb.) Seem. in Journ. Bot. 6:140. 1868.
Gilibertia langeana Marchal, in Bull. Acad. Belg. II. 47:79. 1879.
Sciadophyllum capitatum Eggers, in Vidensk. Meddel. 1889:17. 1889.
Schefflera arborea (L.) Maza, in Anal. Soc. Esp. Hist. Nat. 19:249. 1890.
Schefflera samydifolia (Wr. ex Griseb.) Maza, loc. cit. 1890.
Gilibertia arborea (L.) Marchal, in Bull. Soc. Roy. Bot. Belg. 30[1]:281. 1891.
Sciodaphyllum arboreum (L.) Hitchc. in Rep. Mo. Bot. Gard. 4:91. 1893.
Aralia fruticosa Sessé & Moç. Fl. Mex. 86. 1894.
Aralia tuxtlensis Sessé & Moç. loc. cit. 1894.
Gilibertia rothschuhii Harms, in Engl. Bot. Jahrb. 23:126. 1896.
Gilibertia insularis Rose, in N. Am. Fauna 14:83. 1899.
Gilibertia samydifolia (Wr. ex Griseb.) March. ex Urb. Symb. Ant. 1:201. 1899.
Gilibertia brachypoda Urb. loc. cit. 5:452. 1908.
Dendropanax brachypodum (Urb.) R. C. Schneid. in Bull. Torrey Club 36:644. 1909.
Dendropanax insulare R. C. Schneid. loc. cit. 1909.
Gilibertia stenocarpa Donn. Sm. in Bot. Gaz. 55:435. 1913.
Gilibertia smithiana I. M. Johnston, in Contrib. Gray Herb. 70:81. 1924.
Gilibertia eurycarpa I. M. Johnston, loc. cit. 82. 1924.
Gilibertia alaris (Schlecht.) J. M. Johnston, loc. cit. 1924.
Dendropanax langeanum (March.) Standl. in Contrib. U. S. Nat. Herb. 23:1084. 1924, as syn.
Gilibertia juergenseni (Seem.) Standl. loc. cit. 1924.
Dendropanax monticola Standl. in Journ. Wash. Acad. 17:316. 1927.
Gilibertia concinna Standl. in Trop. Woods 18:30. 1929.
Gilibertia matudai Lundell, in Phytologia 1:372. 1940.
Dendropanax matudai (Lundell) A. C. Smith, in Trop. Woods 66:3. 1941.

Shrubs or trees to 15 m. tall, the branchlets slender, terete. Juvenile leaves often 3- or 4-lobed, to 45 cm. in diameter; petioles to 40 cm. long; mature leaves ovate to elliptic, oblong or obovate-oblong, 6–29 (usually about 15) cm. long, 3–9 (usually about 7) cm. broad, obtusely acuminate to cuspidate at the apex, cuneate to obtuse at the base, entire to undulate or remotely crenate, the costa generally prominent, the primary lateral veins 4–8, often raised on both surfaces. Inflorescences of 3 or more umbels arranged in a terminal raceme, the primary peduncle to 2.5 cm. long, the primary rhachis 2.0–6.5 cm. long, the floriferous peduncles 1–6 cm. long, with several small bracts along their length; pedicels 3–13 mm. long. Flowers to 45 per umbel, 5- to 7-merous, greenish-white; calyx 1.5–2.0 mm. long, minutely denticulate or merely undulate; petals oblong or deltoid-oblong, 1.5–2.0 mm. long, 0.75–1.5 mm. broad, carnose, midrib prominent within, reflexing during anthesis; filaments 1.5–3.0 mm. long, the anthers subglobose-oblong, 0.5–1.0 mm. long, 0.5–0.75 mm. broad; styles connate, free at the apex. Fruit 4–8 mm. in diameter, purple; seeds 5–7.

Sinaloa to Tamaulipas, Cuba, Puerto Rico, and southward; also in South America. A common variable species.

BOCAS DEL TORO: region of Almirante, *Cooper s. n.* CANAL ZONE: Chagres, *Fendler 131*; Barro Colorado Island, *Bangham 430, 595, Starry 294, Shattuck 1026, Aviles 69, 959, Bailey & Bailey 375.* CHIRIQUÍ: Progreso, *Cooper & Slater 173*; llanos west of Gualaca, alt. 500 ft., *Allen 5049*; Río Chiriquí Viejo valley, between El Volcán & Cerro Punta, *G. White 15.* COCLÉ: between Las Margaritas and El Valle, *Woodson, Allen & Seibert*

1741; region north of El Valle de Antón, alt., 1000 m., *Allen 3722, 3747*; vicinity of El Valle, 800–1000 m., *Allen 778*. LOS SANTOS: between Los Santos and Guarate, *Woodson, Allen & Seibert 1202*. PANAMÁ: Cerro Campana, *Allen 2680*. VERAGUAS: vicinity of Ocú, alt. 100 m., *Allen 3648*.

2. DENDROPANAX STENODONTUS (Standl.) A. C. Smith, in Trop. Woods 66:3. 1941.

Gilibertia stenodonta Standl. in Ann. Mo. Bot. Gard. 24:196. 1937.

Shrubs about 4 m. tall, the branchlets slender. Leaves oblong or oblong-oblanceolate, 14–22 cm. long, 4–7 cm. broad, slender-acuminate at the apex, acute at the base, remotely serrate with spreading or ascending linear teeth 1–4 mm. long, the costa prominent, the larger primary lateral veins 4–8 per side; petiole 1.5–7.5 cm. long. Inflorescences of 3 to 6 umbels arranged in a terminal raceme, the primary peduncle slender, 0.5–1.0 cm. long, the primary rhachis 1.5–2.0 cm. long, the floriferous peduncles 1.5–2.5 cm. long, often with several small bracts near their middle; pedicels 4–5 mm. long. Flowers 15–25 per umbel, 5-merous, greenish-cream; calyx about 1 mm. long, obscurely denticulate; petals deltoid-oblong, about 1.5 mm. long, 0.75 mm. broad; filaments to 1.5 mm. long, the anthers subglobose, 0.75 mm. long, 0.5 mm. broad; styles connate, free at the apex. Fruit unknown.

Known only from the type locality.

CANAL ZONE: vicinity of Gold Creek, 4 miles northeast of Gamboa, *Seibert 592*.

3. DENDROPANAX GONATOPODUS (Donn. Sm.) A. C. Smith, in Trop. Woods 66:3. 1941.

Gilibertia gonatopoda Donn. Sm. in Bot. Gaz. 55:434. 1913.

Trees to 16 m. tall, the branchlets stout, terete. Leaves thin-coriaceous, ovate to elliptic, 10–30 cm. long, 4–18 cm. broad, acute to acuminate at the apex, acute to rounded at the base, entire or undulate, the costa prominent, the primary lateral veins 8–10 per side, more or less straight, spreading; petioles 1–12 cm. long. Inflorescences of 4–16 umbels racemosely or umbellately arranged, terminal or lateral, the primary peduncle stout, 0.5–2.0 cm. long, the primary rhachis 0.5–3.0 cm. long, the floriferous peduncles 2–8 cm. long, bracteate and articulate in the lower one-third to one-half; pedicels 2–12 mm. long. Flowers 15–50 per umbel, 5-merous; calyx obconic, 2 mm. long, 1.5 mm. in diameter; petals oblong, 1.5–2.0 mm. long, 1.0–1.5 mm. broad; filaments carnose, 1–2 mm. long, the anthers subglobose-oblong, small; styles connate, forming a short column, free apically. Fruit subglobose, 3–4 mm. in diameter, the styles free and recurved in the distal half; seeds 5.

Costa Rica and Panama.

BOCAS DEL TORO: region of Almirante, *Cooper 380*. CHIRIQUÍ: Bajo Chorro, Boquete District, el. 6000 ft., *Davidson 90*.

4. DENDROPANAX SESSILIFLORUS (Standl. & A. C. Smith) A. C. Smith, in Trop. Woods 66:3. 1941.

Gilibertia sessiliflora Standl. & A. C. Smith, in Ann. Mo. Bot. Gard. 27:326. 1940.

Trees, the branchlets stout. Leaves chartaceous or thin-coriaceous, broadly elliptic, 11–21 cm. long, 7–13 cm. broad, acute at the apex, obtuse at the base, undulate to serrate, the costa prominent, the primary lateral veins 6–10 per side, arcuate-ascending; petioles 1–7 cm. long. Inflorescences of 6–10 heads arranged in a condensed terminal raceme, the primary peduncle 0.5 cm. long, the primary rhachis 0.5 cm. long, the floriferous peduncles 3–4 cm. long, with several connate bracts at about the middle, articulated immediately above the bracts. Flowers 10–15 per head, 5-merous; calyx 2–3 mm. long, about 2 mm. in diameter, the lobes deltoid, acute, about 0.7 mm. long; petals deltoid-lanceolate, 2.5–3.0 mm. long, 1.0–1.5 mm. broad, acute and inflexed at the apex; filaments 3 mm. long, the anthers subglobose-oblong, about 0.75 mm. long; styles connate, the stigmas more or less distinct.

Known only from Panama.

CHIRIQUÍ: Boquete District, el. 3800 ft., *Davidson 769*. SAN BLAS: forest around Puerto Obaldía, alt. 0–50 m., *Pittier 4278*.

5. DENDROPANAX PRAESTANS Standl. in Journ. Wash. Acad. 17:316. 1927.

Gilibertia praestans (Standl.) A. C. Smith, in Brittonia 2:251. 1936.

Small trees, the branchlets rugose, densely leafy at the tips. Juvenile leaves suborbicular, to 40 cm. in diameter, deeply 5- to 7-lobed, serrate; petioles 20–25 cm. long; mature leaves entire or deeply 3-lobed, the entire blades ovate-oblong, 6–13 cm. long, 2–6 cm. broad, acuminate at the apex, obtuse or cuneate at the base, irregularly sinuate-serrate, the teeth obtuse, frequently unequal, the 3-lobed blades 8–15 cm. long and broad, the lobes narrowly oblong, 1.5–3.0 cm. broad, attenuate at the apex, irregularly sinuate, the costa prominent, the primary lateral veins about 6 per side; petioles 1.5–8.0 cm. long. Inflorescences of 5–10 umbels arranged in an axillary compound umbel, the primary peduncle plus rhachis stout, 0.5–1.3 cm. long, the floriferous peduncles about 6 per inflorescence, 1.0–2.5 cm. long, subtended by several more or less connate bracts forming a basal cupule; pedicels 3–5 mm. long, subtended by several more or less connate bracteoles. Flowers 6–15 per umbel, 5- to 7-merous; calyx obconic, somewhat broader than long, 1.5–2.0 mm. long, about 3 mm. in diameter, the teeth apiculate; petals deltoid-oblong, 2–3 mm. long, about 1.5 mm. broad; filaments 1–2 mm. long, the anthers 1.25–1.5 mm. long, 1 mm. broad; styles basally connate. Fruit subglobose, 4–5 mm. in diameter, the styles recurved distally.

Costa Rica and western Panama, 1700–2300 m.

CHIRIQUÍ: humid forest between Alto de las Palmas and top of Cerro de la Horqueta, alt. 2100–2268 m., *Pittier 3213*.

6. DENDROPANAX **alberti-smithii** Nevl. spec. nov.

Arbores usque 30 m. altae; ramulis teretibus rugosis. Folia simplicia oblongo-elliptica usque late obovato-ovalia 10.0–18.5 cm. longa 5–12 cm. lata apice rotundata nisi obscure retusa basi rotundato-cuneata margine obscure repanda coriacea glabra; petiolo 0.5–8.0 cm. longo. Inflorescentia ex umbellis 12–18

Fig. 102. *Dendropanax alberti-smithii*

umbellate composita subsessilis rhachide obsoleta; pedunculis 2–3 cm. longis apice conspicue dilatatis ibique florigeris; pedicellis 2–5 cm. longis ferrugineo-puberulis a cupula bracteolari subtengentibus. Flores circa 50 per umbellam 5–7-meri; calyce cupuliformi; petalis oblongo-deltoidis ca. 2 mm. longis basi 1 mm. latis; staminorum filamentis circa 1 mm longis, antheris 1 mm. longis 0.75 mm. latis; stylis 7 inferne coalitis. Bacca subglobosa ca. 4 mm. longa purpurea; stylis persistentibus apice recurvis.

COCLÉ: region north of El Valle de Antón, alt. 1000 m., *Allen 3738* (MO, HOLOTYPE).

Two inflorescences are present on the type specimen, one fruiting and the other

very immature. The description of the corolla and the androecium is not based on flowers at anthesis but on isolated floral parts which had become lodged in the dense and somewhat moss-encrusted older inflorescense.

7. DENDROPANAX QUERCETI Donn. Sm. in Bot. Gaz. 42:297. 1906.
Gilibertia querceti Donn. Sm. loc. cit. 55:436. 1913.

Shrubs or trees to 17 m. tall, the branchlets rugose. Leaves elliptic to oblong-lanceolate, 5–13 cm. long, 2–5 cm. broad, acuminate at the apex, cuneate at the base, entire or irregularly denticulate, the costa raised, the primary lateral veins prominulous, arcuate-ascending; petioles 0.5–4.5 cm long. Inflorescences generally of a single terminal umbel, rarely with 1 or 2 smaller inconspicuous lateral umbels, the floriferous peduncle 0.5–2.5 cm. long, bracteate in the lower fourth; pedicels 3–15 mm. long. Flowers 5–35 per umbel, 5-merous; calyx obconic, about 2 mm. long and broad, the teeth small, apiculate; petals oblong, 1.5–2.0 mm. long, 1.0–1.5 mm. broad; filaments about 1 mm. long, the anthers about 1 mm. long; styles connate into a short column. Fruit subglobose, 4–7 mm. in diameter, the styles spreading distally.

Costa Rica and western Panama.

CHIRIQUÍ: Río Chiriquí Viejo valley, near El Volcán, *P. White 169*; valley of the upper Río Chiriquí Viejo, alt. 1300–1900 m., *White & White 9*; Bajo Chorro, Boquete District, *Davidson 176, 210, 450.*

8. DENDROPANAX DARIENENSIS Seem. in Journ. Bot. 2:300. 1864.
Gilibertia darienensis (Seem.) I. M. Johnston, in Contrib. Gray Herb. 70:82. 1924.

Slender trees, the branchlets slender, terete. Leaves oblong or obovate, 7–14 cm. long, 3–7 cm. broad, acuminate at the apex, acute at the base, glabrous, entire, the costa raised, the primary lateral veins about 6 per side; petiole 1–5 cm. long. Inflorescence a simple umbel, terminal on a short branchlet, the floriferous peduncle 3–6 cm. long, bracteate at the base and inconspicuously bracteate slightly above the base; pedicels 25–35 mm. long, bracteolate at the base. Flowers 15 (–30 ?) per umbel; young fruit ovoid, about 5 mm. in diameter, surmounted by the short persistent calyx-limb and short stylar column, the styles 5, sharply reflexed, free distally.

Known only from the type collection.

DARIEN: without precise locality, *Seemann s. n.*

4. SCHEFFLERA Forst.

SCHEFFLERA Forst. Char. Gen. 45. 1776, *nomen conservandum.*
Sciodaphyllum P. Br. Hist. Jam. 190. 1756, *nomen rejiciendum.*
Sciadophyllum Reichenb. Consp. 145. 1828.

Shrubs or small trees, sometimes epiphytic, glabrous or variously pubescent. Leaves palmately compound or rarely simple; petiole dilated at the base into a ligulate sheath, often very conspicuous. Inflorescences paniculately umbelliferous or capituliferous, terminal or lateral, the branches subtended by small coriaceous bracts, the umbels or heads numerous; pedicels continuous with the calyx. Flowers

bisexual, 5-merous; calyx obconic or cupuliform, the limb short, erect, usually denticulate; petals usually connate and calyptrate, subacute and slightly thickened distally, valvate; stamens inflexed in bud, the anthers oblong, obtuse at both ends, the thecae loosely coherent or separate; disc slightly raised at the margin; styles 5–7; fruit coriaceous, subglobose, surmounted by the persistent calyx-limb and stylar column or styles, the seeds 5–7 or fewer, oblong.

A genus containing a large number of variable species.

a. Epiphytic shrubs with simple, short-petiolate leaves..... 1. S. EPIPHYTICA
aa. Trees, shrubs or epiphytic shrubs with palmately compound, long-petiolate leaves.
  b. Leaflets 5–9; flowers distinctly pedicellate in 5- to 14-flowered umbels.
    c. Inflorescences 1- to 3-branched near the base; leaflets 5–9; petiolules shallowly canaliculate..... 2. S. SYSTYLA
    cc. Inflorescences compound-paniculate; leaflets 5 or 6; petiolules terete, somewhat swollen proximally and distally..... 3. S. SEIBERTII
  bb. Leaflets 8–21; flowers sessile, in 10- to 12-flowered heads (fruit sometimes as few as 5 per head)..... 4. S. ROBUSTA

1. SCHEFFLERA EPIPHYTICA A. C. Smith, in Ann. Mo. Bot. Gard. 28:437. 1941.

Epiphytic shrubs 1–2 m. tall, glabrous throughout except for the inflorescence, the branchlets striate. Leaves simple, elliptic to elliptic-oblong, 18–25 cm. long, 8–12 cm. broad, abruptly acuminate at the apex, obtuse to subcordate at the base, entire, the costa prominent, the primary lateral veins 10–16 per side, spreading; petiole 0.7–3.0 cm. long, the ligule oblong-linear, to 2.5 cm. long, persistent. Inflorescences of a dozen or more racemosely arranged umbels, terminal, puberulent, the primary peduncle 6–8 cm. long, the primary rhachis 7.5–12.0 cm. long, the floriferous peduncles 0.5–1.0 cm. long; pedicels 2–6 mm. long. Flowers 3–12 per umbel; calyx obconic, 1.0–1.5 mm. long and slightly broader, the limb obscurely apiculate; petals connate into a semiglobose umbonate calyptra 2.0–2.5 mm. in diameter; filaments slender, 4–7 mm. long, the anthers about 1.5 mm. long; styles connate into a column, free apically. Fruit subglobose, to 3.5 mm. in diameter, conspicuously costate.

Known only from Panama.

COCLÉ: El Valle de Antón, alt. 1000 m., *Allen 3423*; region north of El Valle, trail to La Mesa, alt. about 1000 m., *Allen 2723*.

2. SCHEFFLERA SYSTYLA (Donn. Sm.) Viguier, in Ann. Sci. Nat. ser. IX. 9:363. 1909.

Sciadophyllum systylum Donn. Sm. in Bot. Gaz. 31:113. 1901.

Shrubs or trees to 10 m. tall, the branchlets terete, rugose. Leaves palmately compound; leaflets 5–9, the blades elliptic to oblong-oblanceolate, 10–25 cm. long, 3–9 cm. broad, long-acuminate at the apex, acute, cuneate or rounded at the base, both surfaces glabrous, serrate, undulate or entire, the costa prominent, the primary lateral veins 12–18 per side, arcuate-ascending; petioles 12–14 (–30) cm. long, ferrugineous-puberulent becoming glabrescent, the ligule oblong-lanceolate, to 8 cm. long, the petiolules 0.5–6.0 cm. long, canaliculate, densely to sparsely ferrugineous-puberulent. Inflorescences with umbels racemosely arranged in a 1- to

Fig. 103. *Schefflera systyla*

3-branched terminal panicle, ferrugineous-puberulent, the primary peduncle about 5 cm. long, the primary rhachis to 30 cm. long, the floriferous peduncles numerous, 6–15 mm. long, subtended by a bract to 3 mm. long; pedicels 1.5–3.0 (–5.0) cm. long. Flowers 7–10 per umbel; calyx obconic, 1 mm. long, the limb truncate; petals 2 mm. long, connate and calyptrate; filaments to 3 mm. long, the anthers approximately 1 mm. long, 0.5 mm. broad; styles 5–7, connate to the apex. Fruit sharply angled, 2.5–4.0 mm. in diameter, the styles often minutely spreading at the apex, the seeds 5–7 or fewer.

Costa Rica and Panama.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Fish Creek Hills, *Von Wedel 2200, 2294, 2438.* COCLÉ: Cerro Pajita, hills north of El Valle de Antón, 1000–1200 m., *Allen & Allen 4194.*

3. SCHEFFLERA SEIBERTII A. C. Smith, in Trop. Woods 66:5. 1941.

Shrubs or trees to 5 m. tall, the branchlets stout, terete. Leaves palmately compound; leaflets 5 or 6, the blades more or less elliptic-oblong, 15–30 cm. long, (6–) 8–11 cm. broad, cuspidate to acuminate at the apex, obtuse to subcordate at the base, both surfaces glabrous, entire, the costa prominent, the primary lateral veins 7–12 per side, arcuate; petioles to 32 cm. long, lenticellate, the ligule oblong-linear, to 11 cm. long, the petiolules 2–8 cm. long, subterete, somewhat swollen proximally and distally. Inflorescences of racemosely arranged cymes on a terminal panicle, ferrugineous-puberulent, the primary peduncle plus rhachis to 15 cm. long, the secondary peduncles and rhachises about 12, to 50 cm. long, subtended by an oblong-linear bract to 3.5 cm. long, the floriferous peduncles many, 7–10 mm. long, subtended by a bract to 1 mm. long; pedicels 3.0–4.5 mm. long. Flowers 7–14 per umbel; calyx cupuliform, about 0.5 mm. long, the limb minutely denticulate; petals about 2 mm. long, connate and calyptrate; filaments 1.5–2.0 mm. long, the anthers approximately 1 mm. long, 0.75 mm. broad; styles 5, free at the apex.

Panama.

CHIRIQUÍ: Chiriquicito, United Fruit Co., vicinity Guarumo River, *Seibert 1553.*

4. SCHEFFLERA ROBUSTA (A. C. Smith) A. C. Smith, in Trop. Woods 66:5. 1941.

Sciadophyllum robustum A. C. Smith, in Brittonia 2:254. 1936.

Shrubs or trees to 13 m. tall, sometimes epiphytic, the young parts cinereo-puberulent, becoming glabrous, the branchlets stout, terete. Leaves palmately compound, 8–21 leaflets, the blades oblong-lanceolate, 8–30 cm. long, 4–11 cm. broad, caudate-acuminate at the apex, obtuse to rounded at the base, undulate, the costa prominulous, the primary lateral veins 8–20 per side; petioles to 55 cm. long, sheathing at the base, lenticellate, the ligule oblong-lanceolate, to 9 cm. long, the petiolules 2–20 cm. long. Inflorescences with heads borne racemosely in a large terminal panicle, the primary peduncle about 1 cm. long, the primary rhachis 10–15 cm. long or longer, the secondary peduncles 1–2 cm. long, the secondary rhachises to 50 cm. long, the floriferous peduncles 0.5–1.0 cm. long. Flowers 10–20 per head, glabrous; calyx cupuliform, the limb minute, truncate or undulate; petals membranous, connate, deltoid, about 1.5 mm. long; styles connate into a carnose column, free at the apex, the locules and ovules 5. Fruits about 5–15 per head, sharply 5-angled, about 3 mm. in diameter, with a thick stylar column about 1.5 mm. long, the styles shortly free and spreading at the apex.

Costa Rica and Panama.

CHIRIQUÍ: Bajo Chorro, Boquete District, el. 6000 ft., *Davidson 329.* COCLÉ: region north of El Valle, alt. 1000 m., *Allen 3698.*

5. OREOPANAX Dec. & Planch.

Oreopanax Dec. & Planch. in Rev. Hortic. ser. IV. 3:107. 1854.

Monopanax Regel, in Gartenflora 13:35. 1869.

Shrubs or trees, frequently scandent epiphytes when juvenile, sometimes epiphytic at maturity, glabrous or variously pubescent. Leaves simple or palmately compound, lobed or entire; petiole often dilated at the base but without a prominent extended ligule. Inflorescence with heads racemosely arranged in a terminal raceme or panicle, the peduncles swollen distally, the flowers sessile or essentially so, subtended by 2 or more bracteoles, the heads globose or ellipsoid, bracteolate. Flowers polygamo-dioecious (rarely polygamo-monoecious), (4–)5(–6)-merous; calyx cupuliform, the limb short, undulate, truncate or denticulate; petals usually submembranaceous, subacute at the apex, white or greenish, valvate; stamens inflexed in the bud, the anthers oblong, obtuse at both ends; styles in staminate flowers 1 or 2, slender, vestigial, in the pistillate flowers 2–10, free or slightly connate at the base, the ovary thick-walled, the locules as many as the styles. Fruit subglobose or ellipsoid, surmounted by the persistent calyx-limb, the styles often deciduous, the seeds as many as the locules or fewer by abortion.

a. Leaves palmately compound..... 1. O. xalapensis
aa. Leaves simple.
  b. Apex of leaves acuminate, cuspidate or acute.
    c. Leaves glabrous or essentially so.
      d. Basal lateral veins inconspicuous, the venation essentially pinnate, the blades 3–5 times as long as broad..... 2. O. liebmanni
      dd. Basal lateral veins of the leaf-blades in 1 or 2 pairs, conspicuous, ascending or spreading, the blades 1–2 (rarely 3) times as long as broad..... 3. O. capitatus
    cc. Leaves and young branches conspicuously stellate-tomentose..... 4. O. vestitus
  bb. Apex of leaves rounded..... 5. O. costaricensis

1. Oreopanax xalapensis (HBK.) Dec. & Planch. in Rev. Hortic. ser. IV. 3: 108. 1854.

Aralia xalapensis HBK. Nov. Gen. & Sp. 5:8. 1821.
Hedera xalapensis (HBK) DC. Prod. 4:264. 1830.
Aralia ghiesbrechtii A. Vershaffelt ex E. Morren, in Belg. Hortic. 13:3. 1863.
Aralia thibautii A. Vershaffelt ex E. Morren, loc. cit. 1863.
Monopanax ghiesbrachtii (A. Vershaffelt ex E. Morren) Regel, in Gartenflora 18:35. 1869.
Aralia mexicana hort. acc. to Lavallée, Arb. Segrez. 125. 1877, as syn.
Oreopanax thibautii (A. Vershaffelt ex E. Morren) Hook. f. in Bot. Mag. *pl. 6340.* 1878
Oreopanax xalapense var. *laxiflorum* Kuntze, Rev. Gen. 1:271. 1891.
Oreopanax xalapense var. *spiciforme* Kuntze, loc. cit. 1891.
Oreopanax taubertianum Donn. Sm. in Bot. Gaz. 19:4. 1894.
Oreopanax loesernerianus Harms, in Engl. Bot. Jahrb. 23:127. 1896.

Shrubs or trees to 10 m. tall, the branchlets terete, glabrous or sparsely to densely ferrugineous stellate-pubescent. Leaves palmately compound; leaflets 5–10 (rarely 3–12), the blades ovate- to obovate- or lanceolate-elliptic, 5–30 cm. long, 1.5–11.0 cm. broad, short-acuminate to long-caudate at the apex, attenuate at the base, glabrous above, glabrous or sparingly ferrugineous stellate-pubescent below, entire or serrate, the serrations remote, generally in the apical half of the lamina, the costa prominent below, the primary lateral veins spreading; petioles

striate, glabrous or sparsely ferrugineous stellate-pubescent, 7–31 (–60) cm. long, dilated proximally, the petiolules striate, 0.5–3.5 (–25) cm. long. Inflorescences generally ferrugineous stellate-pubescent throughout, racemose or paniculate, the primary peduncle 1–3 cm. long, the primary rhachis 17–40 cm. long, the bracts ovate-oblong, often to 8 mm. long, the floriferous peduncles many, 0.5–2.0 (–4.0) cm. long, glabrous or pubescent. Staminate heads globose or slightly elongate, 5–13 mm. in diameter, the subtending bracts often connate; flowers 20–50 per head; calyx 1.0–1.5 mm. long, about 1 mm. in diameter, the limb essentially truncate; petals deltoid, 1.5–3.0 mm. long, 1.0–1.5 mm. broad; filaments 2–3 mm. long, the anthers about 1 mm. long, 0.5 mm. broad; style 1. Fruiting heads to 1.5 cm. in diameter, the fruits 2–12 (usually about 6) per head, coriaceous, ellipsoid or subglobose, at maturity 5–7 mm. in diameter, the persistent styles 5, recurved, the seeds frequently 4 or 5, sometimes fewer.

Mexico southward to western Panama, 800–3000 m. altitude. Known as *pava* in Panama.

CHIRIQUÍ: Bajo Chorro, Boquete District, elev. 6000 ft., *Davidson 165, 244*; vicinity of Casita Alta, Volcán de Chiriquí, ca. 1500–2000 m., *Woodson, Allen & Seibert 931*; Alto Lino, 990 m., *Bro. Maurice 750*; vicinity of Cerro Punta, alt. 2000 m., *Allen 1561*; Finca Lérida to Peña Blanca, alt. 1750–2000 m., *Woodson & Schery 329*.

One specimen, *Woodson & Schery 329*, has certain vegetative characteristics which would seem to ally it with O. *echinops* (Schlechtd. & Cham.) Dec. & Planch., i.e., the branchlets and petioles are densely ferrugineous stellate-tomentose; 3 to 7 leaflets, broadly elliptic, sessile. Unfortunately the inflorescence of the specimen is much too immature to make a positive determination.

2. OREOPANAX LIEBMANNI Marchal, in Bull. Acad. Belg. II. 47:87. 1879.

Aralia longifolia Sessé & Moç. Fl. Mex. 87. 1894.
Oreopanax microcephalum Donn. Sm. Enum. Pl. Guat. 6:71. 1903, *nomen nudum*.
Oreopanax meiocephalum Donn. Sm. in Bot. Gaz. 37:210. 1904.
Oreopanax oligocarpum Donn. Sm. loc. cit. 1904, as syn.

Trees to 20 m. tall, or epiphytic shrubs, the branchlets slender, stellate-pubescent soon becoming glabrescent. Leaves simple, narrowly elliptic, oblong, obovate or oblanceolate, 6–25 cm. long, 2–6 cm. broad, acuminate at the apex, attenuate to obtuse at the base, glabrous or essentially so, entire, the basal lateral veins inconspicuous, the venation essentially pinnate, the costa raised, the primary lateral veins 6–10 per side, arcuate-ascending; petioles to 15 cm. long, sometimes dilated proximally and distally. Inflorescences paniculate, stellate-pubescent, the primary peduncle 2–5 cm. long, the primary rhachis 5–10 cm. long, the bracts small, inconspicuous, the secondary peduncles 1.0–2.5 cm. long, the secondary rhachises 2–8 cm. long, the floriferous peduncles less than 1 cm. long. Staminate heads subglobose, 1.5–4.0 mm. in diameter, flowers 4–15 per head; calyx broadly cupuliform, 1 mm. long, the limb truncate or undulate; petals 5, oblong-deltoid, about 1.5 mm. long, 0.75 mm. broad at the base; filaments about 1.75 mm. long, the anthers 0.75 mm. long, 0.5 mm. broad; style 1. Bisexual flowers 2–5 per head; calyx, corolla and androecium resembling the staminate flowers; styles 5

(or up to 8), carnose, short. Fruits usually 2 or 3 (or up to 5) per head, ovoid, 3–5 mm. in diameter, surmounted by the persistent styles, the seeds 5 (to 8) or fewer.

Mexico southward to western Panama.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, alt. 6000–7000 ft., *Allen 4925*. CHIRIQUÍ: humid forest around Los Siguas Camp, southern slope of Cerro de la Horqueta, altitude about 1700 m., *Pittier 3184*; valley of the upper Río Chiriquí Viejo, *White & White 961*; Bajo Chorro, Boquete District, el. 6000 ft., *Davidson 279*.

3. OREOPANAX CAPITATUS (Jacq.) Dec. & Planch. in Rev. Hortic. ser. IV. 3:108. 1854.

Aralia capitata Jacq. Enum. Pl. Carib. 18. 1760.
Hedera capitata (Jacq.) J. E. Smith, Ic. Pict. *pl. 4*. 1790.
Hedera frondosa Salisb. Prodr. 144. 1796.
Botryodendrum capitatum (Jacq.) Endl. ex Heynh. Nom. 2:75. 1846.
Sciadophyllum capitatum (Jacq.) Griseb. Fl. Brit. W. Ind. 306. 1860.
Oreopanax destructor Seem. in Journ. Bot. 7:351. 1869.
Aralia ovata Sessé & Moç. Fl. Mex. 86. 1894.

Trees to 15 m. tall, sometimes epiphytic when young, glabrous throughout except for the inflorescence, the branchlets stout, terete, rugose. Leaves simple, ovate, elliptic, lanceolate or obovate, 10–35 cm. long, 4–25 cm. broad, acute or acuminate at the apex, cuneate to subcordate at the base, entire, the basal lateral veins in 1 or 2 pairs, conspicuous; petioles to 30 cm. long. Inflorescence paniculate, stellate-puberulent or glabrous, the primary peduncle plus rhachis 6–20 (–30) cm. long, the bracts inconspicuous, the secondary peduncles and rhachises 4–12 cm. long, the floriferous peduncles 0.5–2.0 cm. long. Staminate heads globose or slightly elongate, flowers 10–25 per head, the bracteoles deltoid or ovate; calyx about 1 mm. long, the limb undulate; petals 5, oblong, 2.0–2.5 mm. long, about 1 mm. broad; filaments about 4 mm. long, anthers about 1.25 mm. long, 0.75 mm. broad; styles 1 or 2. Bisexual heads 5- to 12-flowered; calyx, corolla and androecium resembling the staminate flowers; styles 5–10; fruit subglobose, 5–8 mm. in diameter, the styles recurved, deciduous, the seeds usually few.

Mexico to Cuba and Santo Domingo, and southward; also in South America. A common species to 1700 m. altitude.

BOCAS DEL TORO: Water Valley, vicinity of Chiriquí Lagoon, *Von Wedel 2660*. CANAL ZONE: Barro Colorado Island, *Wetmore & Abbe 247, 248, Aviles 107, 996, Woodson & Schery 980*. CHIRIQUÍ: Volcán de Chiriquí, Boquete District, el. 8500 ft., *Davidson 970*, el. 6000 ft., *Davidson 174, 249, 718*; vicinity of Cerro Punta, alt. 2000 m., *Allen 1574*; vicinity of Boquete, lumber road into the hills east of the Río Caldera, alt. 4500–6500 ft., *Allen 4655*.

4. OREOPANAX VESTITUS A. C. Smith, in Ann. Mo. Bot. Gard. 27:324. 1940.

Trees, shrubs or scramblers to 15 m. tall, more or less densely ferrugineous stellate-tomentose throughout, the hairs sessile or with short slender stalks, the branchlets slender. Leaves simple, elliptic or elliptic-oblong, 9–20 cm. long, 3–7 cm. broad, acuminate at the apex, broadly cuneate to rounded at the base, entire, 3-veined from the base, the costa prominent, the primary lateral veins few; petioles

Fig. 104. *Oreopanax vestitus*

to 10 cm. long. Inflorescence paniculate, the primary peduncle to 1 cm. long, the primary rhachis 8–10 cm. long, the bracts linear oblong, 1–2 mm. long, the secondary peduncles 0.5–2.0 cm. long, the secondary rhachises 1–5 cm. long, the floriferous peduncles less than 1 cm. long. Staminate heads subglobose, 3–5 mm. in diameter, bracteoles minute, flowers 8–15 per head; calyx 1 mm. long, 1.0–1.5 mm. in diameter, the limb truncate; petals 4 or 5, free, ovate-deltoid, 1.25–1.75 mm. long, about 0.75 mm. broad; filaments 2.5–3.5 mm. long, the anthers approximately 1 mm. long, 0.5 mm. broad; styles 1 or 2, about 0.5 mm. long, spreading. Bisexual flowers 5–9 per head; calyx 1.25–1.75 mm. in diameter; petals subconnate and calyptrate, about 1 mm. long, 1 mm. broad; filaments much

shorter than in staminate flowers; styles 4 or 5, erect, free from the base, the locules 4 or 5; fruits about 6 per head, the styles recurved.

Costa Rica and western Panama, alt. 975–2000 m. altitude.

CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, 1300–1900 m., *White & White 40*; trail from Paso Ancho to Monte Lirio, upper valley of Río Chiriquí Viejo, alt. 1500–2000 m., *Allen 1504*.

5. OREOPANAX COSTARICENSIS Marchal, in Bull. Acad. Belg. II. 47:89. 1879.

Trees to 20 m. tall, glabrous throughout, the branchlets stout, rugose. Leaves simple, elliptic or obovate-elliptic, 9–17 cm. long, 4–8 cm. broad, rounded at the apex and at the base, entire, 3- to 5-nerved from the base, the primary lateral veins few; petioles slender, 4–18 cm. long. Inflorescences paniculate, the primary peduncle obsolete, the primary rhachis to 25 cm. long, the bracts inconspicuous, the secondary peduncles 0.5–2.0 cm. long, the secondary rhachises generally to 4 cm. long, sometimes longer, the floriferous peduncles 1–3 cm. long. Staminate heads 5–7 mm. in diameter, the flowers 12–15 per head, the bracteoles ovate, about 1.5 mm. long; calyx small, the limb undulate; petals oblong, about 2 mm. long; filaments to 2 mm. long, the anthers small; styles 1 or 2. Fruits 3 or 4 per head, oblong-ovoid, to 7 mm. long, purple, surmounted by 8–10 short recurved free styles, the seeds often fewer.

Costa Rica and western Panama, 1500–2700 m. altitude.

CHIRIQUÍ: vicinity of "New Switzerland", central valley of Río Chiriquí Viejo, alt. 1800–2000 m., *Allen 1395*; bewteen El Volcán and Cerro Punta, *G. White 24*; near El Volcán, *P. White 171*.

UMBELLIFERAE

BY MILDRED E. MATHIAS AND LINCOLN CONSTANCE

Herbs, or less commonly shrubs or small trees; leaves with or without stipules, usually with a sheathing base, alternate, opposite, or all radical, compound and usually much dissected, or sometimes simple; inflorescence of compound or simple umbels, less frequently of capitulae, often involucrate and, if compound, usually also involucellate; flowers perfect or unisexual, predominantly regular; calyx adnate to the ovary, its 5 lobes prominent and persistent in fruit, to obsolete; alternating with 5 free petals, these usually with an inflexed tip; stamens 5, alternating with the petals; ovary inferior, consisting of 2 uniovulate carpels; styles 2, often swollen at base to form a stylopodium; fruit a schizocarp, the 2 carpels united by their faces (commissure) and commonly separating at maturity, usually suspended from the apex of an axial projection (carpophore), terete or compressed or flattened either laterally or dorsally, normally 5-ribbed, the pericarp usually provided with evident vittae, or oil passages.

A cosmopolitan family, but best represented in the temperate zones and only weakly developed in the tropics. Panama has fewer species than the countries either to the north or the south. Additional adventive species of the family are to be expected in Panama.

a. Inflorescence of distinct simple or compound umbels with distinct rays (and usually pedicels), never capitate; fruits smooth or merely pubescent.
  b. Umbels compound (or some umbels simple); leaves estipulate, the petiole sheathing; fruit without a woody endocarp.
    c. Fruit flattened dorsally, the ribs winged.
      d. Flowers white; involucel present; small trees or shrubs with large leaflets..... 1. MYRRHIDENDRON
      dd. Flowers yellow; involucel usually lacking; annual herbs with filiform leaf-divisions..... 3. ANETHUM
    cc. Fruits compressed laterally, the ribs prominent to indistinct, but not winged.
      e. Inflorescence puberulent; our species a woody-based perennial with large leaflets, a conspicuous involucel, a parted carpophore, and large oblong to oblong-oval fruit..... 2. ARRACACIA
      ee. Inflorescence glabrous; our species an annual with filiform leaf-divisions, no involucel, a shortly cleft carpophore, and small, short-pedicellate, ovoid fruit..... 4. APIUM
  bb. Umbels simple (or proliferous); leaves stipulate, the petiole not sheathing; fruit usually with a woody endocarp (or this obsolete).
    f. Stems erect; leaves opposite; petals with an inflexed apex; carpophore present; fruit flattened dorsally..... 7. SPANANTHE
    ff. Stems creeping; leaves alternate; petals plane; carpophore lacking; fruit flattened laterally..... 8. HYDROCOTYLE
aa. Inflorescence of heads, without rays or pedicels, never of umbels; fruits scaly, tuberculate, or bristly.
  g. Heads of numerous, sessile, perfect flowers; plants spinescent..... 6. ERYNGIUM
  gg. Heads of few, sessile or pedicellate, perfect and staminate flowers intermixed; plants scarcely spinescent..... 5. SANICULA

1. MYRRHIDENDRON Coult. & Rose

MYRRHIDENDRON Coult. & Rose, Bot. Gaz. 19:466. 1894.

Small, glabrous or pubescent trees, or shrubs; stems stout, erect, branched, the leaves petiolate, ternate-pinnately decompound, the leaflets acute or acuminate, the petiole sheathing; inflorescence of terminal and lateral compound umbels, the involucre of a few bracts or lacking, the involucel of few to numerous bractlets; rays numerous, spreading-ascending, the pedicels spreading-ascending; flowers white, the petals with an inflexed apex, the calyx obsolete; stylopodium low-conical, the styles slender, the carpophore parted to the base; fruit flattened dorsally, the dorsal ribs narrowly winged, the lateral broader, the vittae solitary in the intervals, 2 or 3 on the commissure; seed flattened dorsally, sulcate beneath the intervals, its face flat.

Myrrhidendron is one of the most remarkable and interesting genera of Umbelliferae because of its arborescent habit, a clear refutation of the usual dictum that the family, in contrast to the Araliaceae, is "herbaceous." The four species known occupy a collective area extending from Costa Rica to Ecuador. Coulter and Rose executed a monograph of the genus in 1927 (Jour. Wash. Acad. 17:213–215), and an exhaustive anatomical comparison by R. L. Rodríguez C. of the species of *Myrrhidendron* with each other, with other "woody" Umbelliferae, and with representative Araliaceae, was published in Univ. Calif. Publ. Bot. 29: 145–318 1957.

Fig. 105. *Myrrhidendron maxonii*

1. MYRRHIDENDRON MAXONII Coult. & Rose, Jour. Wash. Acad. 17:214. 1927.

Small, glabrous and glaucous tree ("woody herb") 2–4 m. tall from a stout taproot; leaves ovate-deltoid, the blade 3–4 dm. long, the leaflets lanceolate, 2–6 cm. long, spinulose-serrate and laciniately lobed, paler beneath, the petiolules with a membranaceous stipular ring, the petiole with a conspicuous, inflated sheath; cauline leaves reduced upward, sometimes bladeless; peduncles 3–8 cm. long, glandular-puberulent above; involucre of 1–3 linear bracts to 2.5 cm. long, the involucel of several entire to cleft bractlets 5–10 mm. long and exceeding the flowers; fruiting rays unequal, 3–6 cm. long, glandular-puberulent on the angles, the pedicels 7–9 mm. long, glandular-puberulent; fruit linear, 15–20 mm. long.

CHIRIQUÍ: Cuesta Grande, eastern slope of Chiriquí Volcano, 2600–2990 m., *Maxon 5311*; El Potrero Camp, Chiriquí Volcano, 2800–3000 m., *Pittier 3099*; Potrero Muleto to summit, Volcán de Chiriquí, 3500–4000 m., *Woodson & Schery 410*; Valley of the upper Río Chiriquí Viejo, *Peggy White 57;* Volcán de Chiriquí, Boquete District, 10,000 feet, *Davidson 983*; summit and SW face of Cerro Copete, 9000 feet, *Allen 4902*.

This species is known only from Volcán de Chiriquí and Cerro Copete, at elevations of 2600–4000 meters.

2. ARRACACIA Bancroft

ARRACACIA Bancroft, Trans. Agr. Hort. Soc. Jamaica 1825:3. 1825.

Pentacrypta Lehm. Ind. Sem. Hort. Hamburg 16. 1828.

Perennial, glabrous or pubescent herbs from taproots or tubers; stems erect, branched or simple, the leaves petiolate, once or more ternate, pinnate, or ternate-pinnate, the petiole sheathing; inflorescence of terminal and lateral compound umbels, the fertile rays few to numerous, an involucre usually lacking, an involucel commonly present; flowers white to purple or greenish or greenish-yellow, the petals with an inflexed apex, the calyx obsolete; stylopodium conical to indistinct, the styles long or short, the carpophore parted to the base or merely bifid; fruit compressed laterally, usually narrowed at apex, all ribs prominent, acute or obtuse, or filiform and indistinct, the vittae solitary to several in the intervals, 2 or several on the commissure; seed subterete, often sulcate beneath the vittae, its face sulcate or concave.

Arracacia, with some 33 species in the warmer parts of North and South America, is represented in Panama by a single species.

1. ARRACACIA ATROPURPUREA (Lehm.) Benth. & Hook.; Hemsl. Biol. Centr. Amer. Bot. 1:564. 1880.

Pentacrypta atropurpurea Lehm. Ind. Sem. Hort. Hamburg 17. 1828.
Arracacia irazuensis Kuntze, Rev. Gen. 1:265. 1891.
Arracacia Luxeana Coult. & Rose, Bot. Gaz. 18:55. 1893.
Arracacia humilis Rose, Contr. U. S. Nat. Herb. 8:336. 1905.

Slender, woody-based herb 6–40 dm. tall, glabrous except for the puberulent inflorescence; leaves oblong-ovate to ovate-deltoid, the blade 8–20 cm. long, 2–3-ternate, the leaflets oblong-ovate, 2–8 cm. long, 1–3.5 cm. broad, doubly serrate

and often incised, the petiole 8–16 cm. long; cauline leaves reduced upward; peduncles slender, 1–3 dm. long; involucre usually wanting, the involucel of several conspicuous bractlets exceeding the flowers and often the fruit; fertile rays usually 3–8, unequal, spreading, 3–9 cm. long, the fertile pedicels 5–10, 3–12 mm. long; flowers purple or greenish-yellow; stylopodium low-conical, the carpophore parted; fruit oblong to oblong-oval, 4–7 mm. long, 2–4 mm. broad, the ribs acute.

CHIRIQUÍ: savannas, Boquete, Boquete District, 4000 feet, *Davidson 772;* El Boquete, 1000–1300 m., *Pittier 2952;* Potrero Muleto to summit, Volcán Chiriquí, 3500–4000 m., *Woodson & Schery 402;* Loma Larga to summit, Volcán de Chiriquí, 2500–3380 m., *Woodson, Allen & Seibert 1056.*

This highly variable, suffrutescent herb, extending well northward into Mexico, presumably reaches its southern limit in the highlands of Panama at elevations of 1000 to 4000 meters.

3. ANETHUM L.

ANETHUM L. Sp. Pl. 263. 1753.

Strongly anise-scented, glabrous and glaucous annual herbs; stems erect, branched, the leaves petiolate, pinnately decompound, the petiole sheathing; inflorescence of terminal and lateral compound umbels, an involucre and involucel usually lacking; flowers yellow, the petals with an inflexed apex, the calyx obsolete; stylopodium conical; the styles short, reflexed, the carpophore parted to the base; fruit flattened dorsally, all ribs narrowly winged, the lateral broader than the dorsal, the vittae solitary in the intervals, 2–4 on the commissure; seed flattened dorsally, its face flat or slightly concave.

1. ANETHUM GRAVEOLENS L. Sp. Pl. 263. 1753.

Annual herb 4–17 dm. tall; leaves oblong to obovate, the blade 13–35 cm. long, 11–20 cm. broad, pinnately decompound, the ultimate divisions filiform, 4–20 mm. long, the petiole 5–6 cm. long; upper cauline leaves greatly reduced; peduncles 7–16 cm. long; rays 10–45, spreading, 3–10 cm. long, the pedicels 20–50, 6–10 mm. long; fruit ovoid, about 4 mm. long, 2 mm. broad.

BOCAS DEL TORO: slopes of "Cerro Horqueta," 4400 feet, cultivated, *Bro. Maurice 857.*

Anisillo (dill), a European plant adventive throughout the warmer parts of North America, may be expected to be a successful escape in Panama.

4. APIUM L.

APIUM L. Sp. Pl. 264. 1753.

Ciclospermum Lag. Amen. Nat. 101. 1821

Annual, biennial, or perennial glabrous herbs from taproots or creeping rootstocks; stems erect to prostrate, usually branched, the leaves petiolate, pinnate to ternate-pinnately decompound, the petiole sheathing; inflorescence of compound (or frequently some simple) umbels with or without an involucre and involucel; flowers white or greenish, the petals with an inflexed apex, the calyx minute or

obsolete; stylopodium short-conical to depressed, the styles short, the carpophore entire, bifid, or 2-cleft; fruit compressed laterally and constricted at the commissure, the ribs filiform, prominent, obtuse, the vittae solitary in the intervals, 2 on the commissure; seed subterete, its face flat.

This is a very large genus with an essentially cosmopolitan distribution. However, the genus is characterized largely in negative terms, and the intergeneric boundaries and the homogeneity of the group as last monographed by Wolff in 1927 (Das Pflanzenreich 90 [IV. 228]:26–58) leave many problem unresolved.

1. APIUM LEPTOPHYLLUM (Pers.) F. Muell.; Benth. & Muell. Fl. Austr. 3:372. 1866.

Sison Ammi Jacq. Hort. Vindob. 2:95. 1773. Not. L. 1753.
Pimpinella leptophylla Pers. Syn. Pl. 1:324. 1805.
Helosciadium leptophyllum DC. Mém. Soc. Phys. Nat. Hist. Genève 4:493. 1829.
Apium Ammi Urban in Mart. Fl. Bras. 11^1:341. 1879.
Apium Ammi var. *leptophyllum* Chodat & Wilczek, Bull. Herb. Boiss. II. 2:526. 1902.
Helosciadium Ammi Britton, Fl. Bermuda 279. 1918.
Cyclospermum leptophyllum Sprague, Jour. Bot. 61:131. 1923.

Annual herb 0.5–6 dm. tall, alternately branched above; leaves oblong-ovate, the blade 3.5–10 cm. long, 3.5–8 cm. broad, 3–4-pinnately decompound, the ultimate divisions filiform, 1.5–7 mm. long, the petiole 2.5–11 cm. long; umbels compound or some simple, pedunculate or sessile, the peduncles to 2 cm. long; involucre and involucel lacking; rays 3–5, 1–2.2 cm. long, the pedicels 2–8 mm. long; carpophore shortly 2-cleft; fruit ovoid, 1.2–3 mm. long, 1.5–2 mm. broad.

CHIRIQUÍ: Valley of the upper Río Chiriquí Viejo, *Peggy White 30*.

This species, originally described from the West Indies, is native to the warmer parts of the western hemisphere and has become adventive pantropically.

5. SANICULA L.

SANICULA L. Sp. Pl. 235. 1753.

Perennial or biennial, glabrous, or pubescent herbs from taproots, rootstocks, tubers, or fascicled roots; stems (sometimes obsolete) erect to rarely decumbent, simple or branched, the leaves petiolate, lobed or divided to decompound, rarely entire, the petiole sheathing; inflorescence of cymosely, umbellately, or paniculately arranged small heads subtended by a foliaceous involucre, the flowers perfect and staminate, white, yellow, or purple, the petals with an inflexed apex, the calyx very prominent and persistent; stylopodium lacking, the styles short to elongate, a carpophore lacking; fruit somewhat compressed laterally and densely tuberculate, scaly, or bristly, sessile or stipitate, the ribs obsolete, the vittae irregularly arranged, prominent to obscure; seed subterete or flattened dorsally, often sulcate beneath the vittae, its face flat to concave or sulcate.

Sanicula, another of the most distinctive genera of the family, consists of some 40 species distributed in a semi-cosmopolitan pattern, but concentrated in the temperate zones. The genus was monographed by Wolff in 1913 (Das Pflanzen-

reich 61 [IV. 228]:1–305) and by Shan and Constance in 1951 (Univ. Calif. Publ. Bot. 25:1–78). The interpretation of the inflorescence as consisting of capitulae (condensed simple umbels) or heads instead of "irregularly compound umbels"—the more usual view—is taken from the discriminating essay on, "The Umbelliferae of North Carolina and their distribution in the southeast" (Jour. Elisha Mitchell Sci. Soc. 66:195–266. 1950) by Charles L. Rodgers. The earlier treatment of the family by Mathias and Constance in NORTH AMERICAN FLORA separated the genera *Sanicula* and *Eryngium* widely. We now firmly believe this to have been a mistake. In returning the genera to closer juxtaposition, it is helpful to interpret their characteristics in comparable terms.

1. SANICULA LIBERTA Cham. & Schlecht. Linnaea 1:353. 1826.

Sanicula mexicana DC. Prodr. 4:84. 1830.

Perennial herb from a fleshy rhizome, glabrous, the stem usually solitary, 2–6 dm. tall, dichasially branched; leaves broadly cordate-orbicular to suborbicular, the blade 2.5–8 cm. long, 3.5–10 cm. broad, palmately 5-parted, the primary leaflets petiolulate, setose-crenate and incised, the petiole 5–23 cm. long; cauline leaves reduced upward; peduncles 5–45 mm. long, sterile and fertile flowers intermixed, the former pedicellate; flowers pale green, the calyx-teeth narrowly lanceolate, acuminate; styles longer than the fruit-prickles; fruit usually 2 or 3 in each head, subglobose, 2–4 mm. long, 2–4 mm. broad, stipitate, densely uncinate-bristly, the vittae small, several on the dorsal and lateral surfaces, 2 on the commissure; seed flattened dorsally, its face flat.

CHIRIQUÍ: Bajo Chorro, Boquete District, 6000 feet, *Davidson 716*; vicinity of El Boquete, 1000–1300 m., *Maxon 5007*; Caldera River below Quiel, forests around El Boquete, 1000–1300 m., *Pittier 3148*; foot of Pianista, vicinity of El Boquete, 1350 m., *Bro. Maurice 708*; vicinity of Casita Alta, Volcán de Chiriquí, 1500–2000 m., *Woodson, Allen & Seibert 963*; vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, 1800–2000 m., *Allen 1353*; Valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, 1300–1900 m., *Seibert 294*; llanos on slopes of Volcán de Chiriquí Viejo and along Río Chiriquí Viejo, 1200 m., *Allen 965*.

A plant of the forests and forest clearings, at altitudes of 1000–2000 meters in Panama, it extends from Chihuahua, Mexico, to Córdoba, Argentina.

6. ERYNGIUM L.

ERYNGIUM L. Sp. Pl. 232. 1753.

Biennial or perennial, usually glabrous herbs (our species) from stout taproots or rootstocks; stems (when present) prostrate to erect, simple or branched, the leaves mostly petiolate, entire to lobed or divided, usually spinose, the petiole sheathing; inflorescence of solitary to numerous involucrate heads, the flowers all perfect, white, blue, or purple, each subtended by an involucel (floral) bractlet, the petals with an inflexed, lobed to fimbriate apex, the calyx prominent, often spinescent; stylopodium lacking, the styles shorter than to exceeding the calyx, a carpophore lacking; fruit subterete, scaly or tuberculate, the ribs obsolete, the

Fig. 106. *Sanicula liberta*

commissure broad, the vittae inconspicuous; seed subterete, its face flat or slightly concave.

Short-caulescent or acaulescent perennial from a taproot; leaves without callous margins, coarsely spinose-serrate; heads violet-blue, ovoid, the bracts 8–10, oblanceolate to ovate, chartaceous; calyx-teeth 1.5–2 mm. long; fruit-angles scaly, the faces papillose	1. E. CARLINAE
Caulescent, branched biennial from fibrous, fascicled roots; leaves callous-margined, crenate to finely spinulose-serrate; heads greenish, cylindrical, the bracts 5–6, lanceolate, foliaceous; calyx-teeth 0.5 mm. long; fruit densely tawny-papillose on both angles and faces	2. E. FOETIDUM

Eryngium is probably the largest (200–250 species) and most distinctive genus of the family, with its commonly thistle-like aspect. The genus is essentially cosmopolitan, although tending to avoid East Asia, and tropical and South Africa.

1. ERYNGIUM CARLINAE Delar. f. Eryng. 53. 1808.

Eryngium affine H. Wolff, Repert. Sp. Nov. 7:345. 1909.

Low herb, the stems solitary to several, decumbent to erect, 0–25 cm. tall; basal leaves oblanceolate, the blade 3–8 cm. long, 5–18 mm. broad, long-cuneate, obtuse, coarsely serrate and often incised or lobed, the petiole broadly winged, 0.5–2 cm. long; cauline leaves few, the upper sessile, often parted; inflorescence trifurcate or weakly cymose, the heads few, 7–10 mm. long, 5–7 mm. broad; bracts 8–10, 8–20 mm. long, 2–6 mm. broad, spinose-serrate apically, green or blue beneath and white above, usually exceeding the head, the bractlets subulate, 2–3 mm. long, slightly exceeding the fruit, the coma of 1–3 bractlets 2–5 mm. long, occasionally obsolete; calyx-teeth ovate, obtuse, mucronate; styles shorter than the calyx; fruit ovoid, 1.5–2 mm. long.

CHIRIQUÍ: Valley of the upper Río Chiriquí Viejo, *Peggy White 52*.

This species is widespread and variable, extending from central Mexico to Costa Rica and Panama.

2. ERYNGIUM FOETIDUM L. Sp. Pl. 232 (excluding synonymy). 1753.

Slender herb, the stem usually solitary, erect, branched, 0.5–6 dm. tall; basal leaves lanceolate or oblanceolate, the blade 3–27 cm. long, 1–5 cm. broad, cuneate, obtuse, the petiole short or obsolete, up to 3 cm. long; cauline leaves numerous, the upper sessile and usually opposite, spinulose-serrate to parted; inflorescence trifurcate, the lateral branches usually continuing to form a monochasium, the heads numerous, 7–11 mm. long, 3–5 mm. broad; bracts 5 or 6, 1–4 cm. long, 2–10 mm. broad, entire or nearly so, green on both surfaces, greatly exceeding the head, the bractlets linear to lanceolate, 2–3 mm. long, exceeding the fruit, the coma conspicuous or lacking; calyx-teeth lanceolate to ovate, acute, weakly mucronate; styles slightly exceeding the calyx; fruit globose, about 1.5 mm. long.

"Isthmus of Panamá," 6 April 1882, *J. Ball*. BOCAS DEL TORO: *von Wedel 406*; Island Potrero, Changuinola Valley, *Dunlap 207*; Water Valley, vicinity of Chiriquí Lagoon, *von Wedel 1644*. CANAL ZONE: Ahorca Lagarto to Culebra, *Cowell 371*; Hospital Grounds at Ancón, 20–80 m., *Pittier 3959*; Barro Colorado Island, *L. H. & Ethel Z. Bailey 499, Shattuck 132, Starry 189, Kenoyer 487*; Las Cascadas Plantation, *Standley*

29,546; Cerro Gordo, near Culebra, *Standley 25,981*; Chagres, *Fendler 133*; vicinity of Corozal, *Piper 5305*; near Fort Randolph, *Standley 28,674*; vicinity of Gatuncillo, *Piper 5645*; Margarita Swamp, S of France Field, *Maxon & Valentine 7053*; vicinity of Miraflores Lake, *G. & Peggy White 189*; Mount Hope Cemetery, *Standley 28,773*; forests around Puerto Obaldía, San Blas coast, 0–50 m., *Pittier 4364*; Mandingo Valley, hills between Río Grande and Pedro Vidal on road to Arraiján, 50–150 m., *Pittier 2712*; Las Sabanas, *Bro. Celestine 107, Bro. Paul 140*; Taboga Island, *Standley 27,929*. CHIRIQUÍ: Boquete, Boquete District, *Davidson 570*. COCLÉ: Penonomé and vicinity, 50–1000 feet, *Williams 191*. COLÓN: between France Field and Cativa1, *Standley 30,258*. PANAMÁ: vicinity of Juan Franco Race Track, near Panamá, *Standley 27,749*.

This is a common species in tropical North and South America, and is adventive in more tropical areas of the Old World as well. Variously described as "aromatic," or as having an odor that is "strong," "peculiar," "nauseous," or "offensive," the plant is prized as an internal medicine and for flavoring food.

7. SPANANTHE Jacq.

SPANANTHE Jacq. Coll. 3:247. 1789.

Annual, glabrous to pubescent herbs; stems slender, erect, dichotomously branched, the leaves opposite, petiolate, simple, crenate-dentate, the petiole with lacerate, scarious, adnate stipules setulose-hairy at apex; inflorescence of simple, pedunculate, paniculately arranged, axillary and terminal umbels, the involucre of several small bracts; rays spreading-ascending; flowers white or greenish-white, the petals with a short inflexed apex, the calyx prominent; stylopodium depressed-conical, the styles short, the carpophore entire; fruit flattened dorsally and constricted at the commissure, the ribs filiform, the vittae minute or wanting; seed flattened dorsally, its face plane.

Spananthe is a distinctive monotypic genus of the warmer parts of the western hemisphere.

1. SPANANTHE PANICULATA Jacq. Coll. 3:247. 1789.

Hydrocotyle Spananthe Willd. Sp. Pl. 1:1363. 1798.
Spananthe setosa Moench. Meth. Suppl. 34. 1802.
Spananthe angulosa Turcz. Bull. Soc. Nat. Mosc. 20^1:171. 1847.

Annual herb 2–15 dm. tall; leaves deltoid-ovate, the blade 1.5–14 cm. long, 0.5–14 cm. broad, acuminate, subcordate to truncate, dentate-crenate, setose-pubescent on the veins and with a tuft of hairs at junction of petiole and blade, the petiole 0.7–15 cm. long; cauline leaves becoming narrower and subsessile upward; peduncles 0.7–14 cm. long, hirtellous-pubescent beneath the umbel; rays several, 7–10 mm. long; fruit ovoid, 2–4 mm. long, about 2 mm. broad.

CANAL ZONE: vicinity of Gatuncillo, *Piper 5651*; Barro Colorado Island, *Aviles 18*.

8. HYDROCOTYLE L.

HYDROCOTYLE L. Sp. Pl. 234. 1753.

Perennial, glabrous or pubescent creeping herbs; stems rooting at the nodes, the leaves petiolate, peltate or not, simple, entire to parted, the petiole not sheathing, stipulate; inflorescence of simple, or proliferous, umbels borne on axillary

peduncles, or subsessile, an involucre present or lacking; rays spreading to reflexed; flowers white, greenish, or yellow, the petals plane, the calyx minute or obsolete; stylopodium conical to depressed, the styles short to elongate, a carpophore lacking; fruit strongly flattened laterally, the dorsal ribs acute or obsolete, the lateral usually conspicuous, the carpels orbicular to triangular in transection, oil-bearing cells conspicuous to obsolete, and strengthening cells usually surrounding the seed cavity, or these obsolete; seed ovate to ovate-oblong in transection, its face plane to concave.

Leaves orbicular-reniform, non-peltate.	
Plants pubescent; umbels 25–70-flowered; fruit-ribs evident	1. H. MEXICANA
Plants glabrous; umbels 5–10-flowered; fruit-ribs obsolete	2. H. RANUNCULOIDES
Leaves orbicular, peltate.	
Fruit sessile; plants pubescent; umbels 2–6-flowered	3. H. PUSILLA
Fruit pedicellate; plants glabrous; umbels many-flowered.	
Umbels simple; fruit-ribs obtuse	4. H. UMBELLATA
Umbels proliferous and hence irregularly compound; fruit-ribs acute.	5. H. BONARIENSIS

Hydrocotyle is a large, distinctive genus of perhaps 100 species, usually easily recognizable by its creeping stems, rounded leaves, simple umbels, laterally flattened fruits, and its preference for moist or wet habitats. It is primarily a genus of the southern hemisphere, but extends well into and across the tropics in both the New and Old Worlds. Its ability to thrive under tropical conditions, uncharacteristic of the Umbelliferae in general, permits it to be the largest of the family in Panama, with 5 species thus far reported and others to be expected.

Fig. 107. *Hydrocotyle mexicana*

1. HYDROCOTYLE MEXICANA Schlecht. & Cham. Linnaea 5:208. 1830.

Stems slender; leaves 8–90 mm. in diameter, 7–11-lobed, the lobes crenate, appressed-strigose on the veins, the petiole 1–23 cm. long, hirsute above; peduncles hirsute, longer than the leaves; rays glabrous, 1–7 mm. long; fruit suborbicular, 1–1.5 mm. long and broad, the ribs acute.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, 6000–7000 feet, *Allen 4969*. CHIRIQUÍ: upper Caldera watershed above El Boquete, 1650–1925 m., *Maxon 5644*; vicinity of Casita Alta, Volcán de Chiriquí, 1500–2000 m., *Woodson, Allen & Seibert 854*; Jaramillo, Boquete District, 5000 feet, *Terry 1285*; vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, 1800–2000 m., *Allen 1373*; Río Chiriquí Viejo valley, near El Volcán, *Peggy White 182*; valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, 1300–1900 m., *Seibert 161*; on way up "cerro Pianista" (S. del Boquete), 4400 feet, *Bro. Maurice 853*. DARIEN: Cana, 2000 feet, *Williams 783*.

This species is an inhabitant of humid forests, in Panama at altitudes of 700–2300 meters, extending from central Mexico to northern South America.

2. HYDROCOTYLE RANUNCULOIDES L. f. Suppl. 177. 1781.

Hydrocotyle natans Cirillo, Pl. Rar. Neap. 1:20. 1788.
Hydrocotyle batrachioides DC. Prodr. 4:667. 1830.

Stems slender or succulent; leaves 5–80 mm. in diameter, deeply 5–6-lobed, the lobes crenate or lobulate, glabrous, the petiole 1–35 cm. long, glabrous; peduncles glabrous, shorter than the leaves; rays glabrous, 1–3 mm. long; fruit suborbicular, 1–3 mm. long, 2–3 mm. broad, the ribs obsolete.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 226*.

A true aquatic and frequently floating, this species occurs widely in both North and South America.

3. HYDROCOTYLE PUSILLA A. Rich. Ann. Gén. Sci. Phys. 4:167. 1820. Not R. Br. 1820.

Hydrocotyle brevipes DC. Prodr. 4:63. 1830.
Hydrocotyle costaricensis Rose; Rose & Standley, Jour. Wash. Acad. 17:195. 1927.

Stems filiform; leaves 3–20 mm. in diameter, shallowly 5–8-lobed, the lobes crenate, glabrous to villous above, glabrous beneath, the petiole 5–35 mm. long, glabrous to densely retrorse-villous; peduncles glabrous to retrorse-villous, about equaling the leaves; rays obsolete or nearly so; fruit ellipsoid, 0.5 mm. long by 1 mm. broad, the ribs obsolete.

CANAL ZONE: Balboa, weed in Powell's garden, *Standley 28,563*.

A species originally collected near Montevideo, Uruguay, by Commerson, this is now known widely from South and Central America and the West Indies.

4. HYDROCOTYLE UMBELLATA L. Sp. Pl. 234. 1753.

Hydrocotyle umbellulata Michx. Fl. Bor. Amer. 1:161. 1803.
Hydrocotyle polystachya A. Rich. Ann. Gén. Sci. Phys. 4:171. 1820.
Hydrocotyle petiolaris DC. Prodr. 4:60. 1830.
Hydrocotyle fluitans DC. Prodr. 4:69. 1830.
Hydrocotyle scaposa Steud. Flora 26:763. 1843.

Stems slender or succulent; leaves 5–75 mm. in diameter, crenate or crenately lobed, glabrous, the petiole 0.5–40 cm. long, glabrous; peduncles glabrous, usually longer than the leaves; rays glabrous, 2–25 mm. long; fruit ellipsoid, 1–2 mm. long, 2–3 mm. broad, the ribs obtuse.

Valley of Río Panduro, 1500 m., *Killip 3577*. BOCAS DEL TORO: Isla Colón, vicinity of Chiriquí Lagoon, *von Wedel 2955*. CANAL ZONE: Balboa, weed in Powell's garden, *Standley 28,557*; Barro Colorado Island, *Wilson 57, Woodworth & Vestal 565*; Matachui to Las Cascadas, *Cowell 356*. CHIRIQUÍ: Chiquero, Boquete District, 5500 feet, *Davidson 547*; Finca Lérida to Boquete, 1300–1700 m., *Woodson, Allen & Seibert 1151*; vicinity of El Valle de Antón, ca. 600 m., *Allen 1991*; on way to "Palo Alto" (Sierra del Boquete), 4700 feet, *Bro. Maurice 856*. COCLÉ: El Valle de Antón and vicinity, 500–700 m., *Seibert 447*; Penonomé and vicinity, 50–1000 feet, *Williams 403*. PANAMÁ: Corozal Road near Panamá, *Standley 26,819*.

Wet places throughout the temperate and warmer Americas, and apparently adventive elsewhere.

5. HYDROCOTYLE BONARIENSIS Lam. Encyc. 3:153. 1789.

Hydrocotyle multiflora R. & P. Fl. Per. 3:24. 1802.
Hydrocotyle yucatanensis Millsp. Field Mus. Publ. Bot. 2:81. 1900.

Stems slender; leaves 1–12 cm. in diameter, shallowly 12–19-lobed, the lobes crenate, glabrous, the petiole 2–38 cm. long, glabrous; peduncles glabrous, longer than the leaves; rays glabrous, 2–20 mm. long; fruit ellipsoid, 1–2 mm. long, 2–4 mm. broad, the ribs acute.

CANAL ZONE: Chagres, *Fendler 132*. COLÓN: vicinity of Camp Pina, 25 m., *Allen 3593*.

Although originally known from Montevideo and Buenos Aires, this is now reported widely from the warmer parts of the New World. Its proliferous inflorescence in company with peltate leaves is quite distinctive.*

* The writers are grateful to the curators of the following herbaria for the opportunity of examining their Panamanian material of Umbelliferae: Chicago Museum of Natural History, Gray Herbarium of Harvard University, Missouri Botanical Garden, New York Botanical Garden, United States National Museum.

CORNACEAE

1. CORNUS L.

CORNUS L. Sp. Pl. 117. 1753.

Chamaepericlymenum Hill, Brit. Herb. 331. 1756.
Benthamia Lindl. in Edw. Bot. Reg. *pl. 1579*. 1833, nec A. Rich (1828) necque Lindl. (1830).
Cynoxylon Raf. Alsogr. 59. 1838.
Eukrania Raf. loc. cit. 1838.
Benthamidia Spach, Hist. Veg. 8:106. 1839.
Svida Opiz (Seznam 94. 1852, nom. nud.) ex Small, Fl. SE. U. S. 853. 1903.
Cornella Rydb. Bull. Torrey Bot. Club 33:147. 1906.
Macrocarpium Nak. in Bot. Mag. Tokyo 23:38. 1909.

Fig. 108. *Cornus disciflora*

Arctocrania Nak. loc. cit. 39. 1909.
Mesomora Lunell, in Amer. Midl. Nat. 4:487. 1916.
Ossea Lunell, loc. cit. 1916.

Trees and shrubs, rarely rhizomatous subshrubs. Leaves opposite, rarely alternate, estipulate, simple, entire, usually petiolate. Inflorescence an ebracteate corymbiform or umbelliform cyme or (in our species) densely capituliform and subtended by usually 4 involucrate bracts. Flowers small, hermaphrodite, epigynous. Sepals 4, small, slightly united at the base. Petals 4, valvate. Stamens 4, the anthers 4-celled, dorsifixed, versatile. Ovary inferior, 2-celled, each cell with a single pendulous ovule; style 1, arising from a fleshy epigynous disc, the stigma minute, capitate. Fruit a drupe, usually containing a single seed.

About 40 species of North America, Europe, Asia and tropical Africa. A single species is found in Panama.

1. CORNUS DISCIFLORA Moç. & Sessé, ex DC. Prodr. 4:273. 1830.

Cornus capitata Sessé & Moç. Fl. Mex. 28. 1893, non Wall. (1820).
Cornus floccosa Wanger. in Fedde, Repert. 6:101. 1908.
Benthamia disciflora (Moç. & Sessé) Nak. in Bot. Mag. Tokyo 23:41. 1909.
Cornus disciflora var. *floccosa* (Wanger.) Standl. in Field Mus. Publ. Bot. 8:321. 1931.
Cornus disciflora f. *floccosa* (Wanger.) Rickett, in Bull. Torrey Bot. Club 72:223. 1945.

Shrubs or small trees to about 12 m. tall, the small branchlets conspicuously nodose, very finely appressed-sericeous when young. Leaves opposite, petiolate; blade oblong- or ovate-elliptic, acuminate, cuneate, about 7–14 cm. long and 2–6 cm. broad, with 3–5 pairs of ascending veins, firmly membranaceous, above opaque and essentially glabrous, beneath paler and minutely sericeous or tomentellous; petiole about 1–2 cm. long. Inflorescences terminal or subterminal, pedunculate, capituliform, involucrate; peduncle 1–2 cm. long, somewhat accrescent in fruit, minutely sericeous or tomentellous; flowering heads about 1 cm. in diameter, many-flowered, subtended by 2 pairs of deciduous, broadly ovate, sericeous bracts about 5 mm. long. Flowers minute, the ovary and hypanthium about 1 mm. long, densely and minutely sericeous, about as long as the subdeltoid calyx-lobes, the petals white, about 3 mm. long, reflexed at anthesis, the stamens somewhat shorter than the petals and widely exserted. Drupes deep red to purplish black, broadly oblong-ellipsoid, sparsely sericeous to glabrate, up to about 10 mm. long and 7 mm. thick.

Mexico to Panama (mountains of Chiriquí, at high elevations).

CHIRIQUÍ: Bajo Chorro, *Davidson 402*; on way to Palo Alto, Sierra de Boquete, *Bro. Maurice 710*; south of Finca Lérida, *Allen 4767*; vicinity of Finca Lérida, *Woodson & Schery 228*; Volcán de Chiriquí, *Davidson 985*; Casita Alta, Volcán de Chiriquí, *Woodson, Allen & Seibert 793*.

It always comes as a shock for a *norteamericano* to recognize in this species a southern relative of the northern Flowering Dogwood, *Cornus florida* L. The flowering bud scales of *C. disciflora,* however, are far smaller and are seldom seen since they are quite caducous and fall before anthesis. The fruits, only 1 to 3 maturing, are quite showy.

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A REVISION OF THE GENUS DAPHNOPSIS*

LORIN I. NEVLING, JR.

ABSTRACT

The present revision of *Daphnopsis* (Thymelaeaceae) attempts to relate the sparse knowledge of morphologic and, particularly, taxonomic information into a single body which, it is hoped, will eventually lead to a better understanding of the genus. *Daphnopsis* has never been the subject of inclusive taxonomic revision since its foundation in 1824. Past and present knowledge of the genus is extremely meager and is generally limited to uncorrelated specific descriptions. In only a few instances have fragmentary taxonomic keys been provided and then never to more than a half-dozen species.

This revision is based upon the study of herbarium specimens from many of the more important herbaria of the world. These collections include most of the type specimens of the taxa treated in the revision.

The account includes a brief discussion of the inflorescence and its more prominent evolutionary trends. Anatomy and morphology of the flower are discussed with special emphasis on the corolla. Four basic modifications of the corolla are presented.

This revision recognizes two subgenera encompassing forty-six species. Subgenus DAPHNOPSIS is composed of thirty-four species, and subgenus NEIVIRA of twelve species. New taxa are *D.* **alainii**, *D. americana* ssp. **guatemalensis**, *D.* **brevifolia**, *D.* **equatorialis**, *D.* **hispaniolica**, *D.* **liebmannii**, *D.* **macrocarpa**, *D.* **mexiae**, and *D.* **perplexa** in subgenus DAPHNOPSIS, and *D.* **boliviana** and *D.* **sanctae-teresae** in subgenus NEIVIRA. *Daphnopsis* **anomala** (HBK.) Nevl. and several of the subspecies of *D. cuneata* and *D. americana* are new combinations. Analytical keys to the subgenera, species and subspecies are presented, as is a key to the American genera of the Thymelaeaceae. Each species is described, with particular emphasis on the inflorescence and the flower, and illustrated. The illustration includes the known range of the species, as determined by the specimens examined, and a semi-diagrammatic drawing of a staminate and a pistillate flower when possible. LORIN I. NEVLING, JR., Arnold Arboretum, Cambridge, Mass.

INTRODUCTION

Since the foundation of the thymelaeaceous genus *Daphnopsis* in 1824 by Martius and Zuccarini,[1] an abundance of specific and infraspecific epithets has accumulated which has never been the subject of inclusive taxonomic revision. Past and present knowledge of the genus is extremely meager and is generally limited to uncorrelated specific descriptions. In only a few instances have fragmentary taxonomic keys been provided, and then never to more than a half-dozen

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Issued January 28, 1960.

* An investigation carried out in the graduate laboratory of the Henry Shaw School of Botany of Washington University and submitted as part of a thesis in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

[1] Martius, C. F. P de & J. G. Zuccarini, Nov. Gen. & Sp. 1:65. 1824.

species. What little is known of the genus has remained largely uncorrelated because of the inadequacies and difficulties involved in precise specific determination, the keystone of biological coordination and knowledge. The primary reason the taxonomy has been so cumbersome is that the plants are dioecious and the flowers small and relatively unattractive, conditions which make any study considerably difficult.

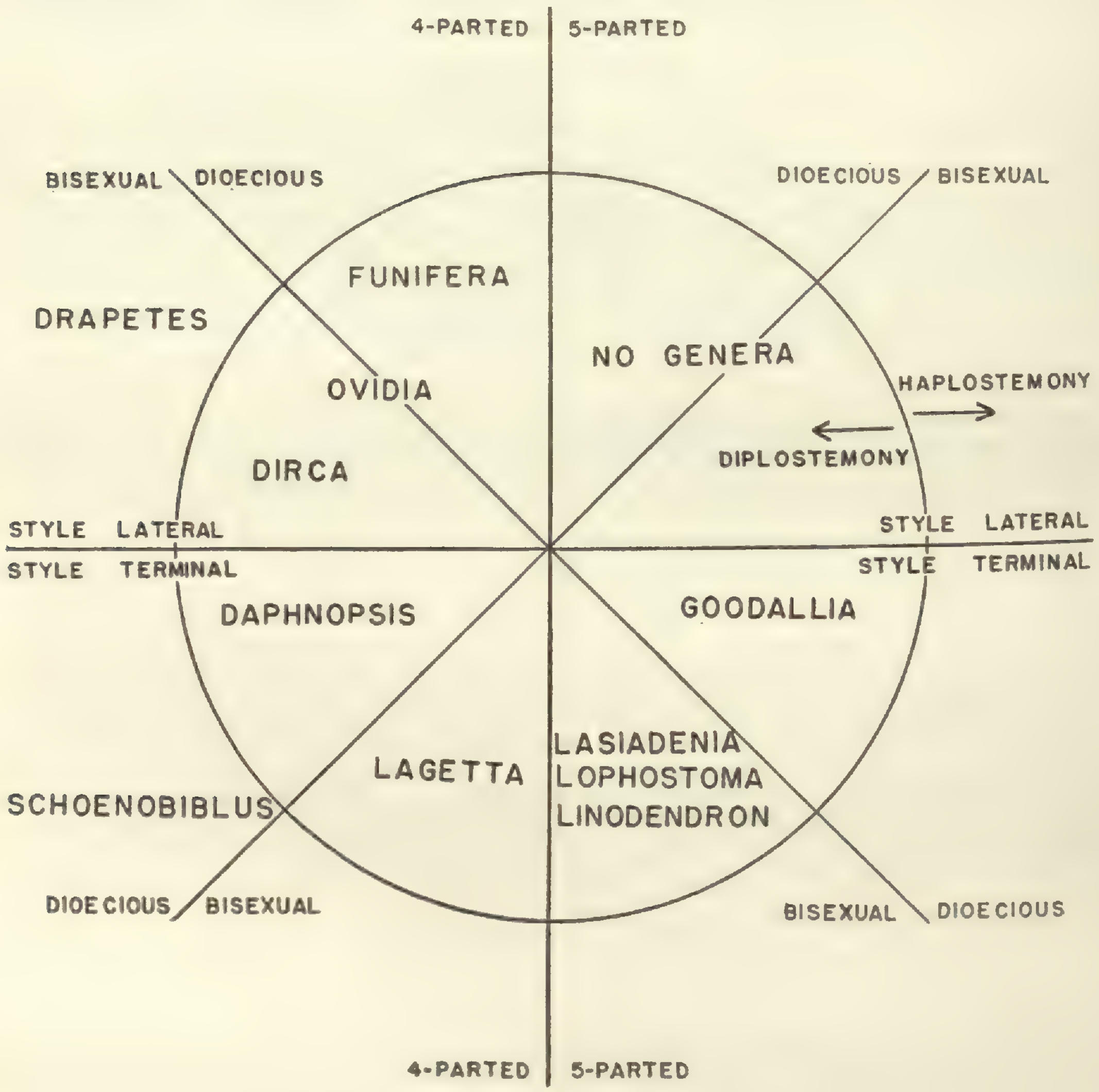

Fig. 1. Schematic Representation of the American Genera

Domke,[2] in 1934, published an excellent but generalized over-all account of the Thymelaeaceae, but to scarcely more than the generic level. I have interpreted *Daphnopsis* in a somewhat stricter sense than he so that it has been necessary to redefine more precisely the generic limits. The present revision, although incomplete in many respects, attempts to correlate the sparse knowledge of morphologic, and particularly, taxonomic information into a single body which, it is hoped, eventually will lead to a better understanding of the genus.

Taxonomic Position and Relationships

The Thymelaeaceae are generally classified as a family of the order Myrtiflorae, whose flowers show a transition from perigyny, in the more primitive families, to epigyny, in the more advanced. The Thymelaeaceae, because of their perigynous flowers with superior ovary, are generally considered primitive within the order. The family is composed of approximately fifty-five genera of which eleven are represented in the New World. The largest New World genus is *Daphnopsis* which includes forty-six species.

The American genera, as a group, are poorly known but it is my intention to discuss *Daphnopsis* only in relation to them. The facts involved are derived from Domke's[3] study and my personal observations. In order to present these facts in an objective manner I have used a diagrammatic scheme (Figure 1) which uses some of the more important morphologic trends. The scheme is divided by a median vertical line which separates the genera with 4-parted calyces from those with 5-parted calyces; the median horizontal line separates those genera with terminal styles from those with lateral styles; the diagonal lines divide each quarter into those genera with bisexual flowers from those with dioecious flowers; finally, the entire scheme is divided by the circle, diplostemonous genera within, haplostemonous genera without the periphery. Thus both levels of development and the relationships of the genera to them are presented without relying on hypothetical phylogenetic "trees".

It may be of interest to contrast my scheme with an abstract of the classification by Domke[4] for which I supply only the American genera (Figure 2). There is a high correlation between the two schemes. Those American genera which Domke has indicated as of uncertain position all appear to me to be members of the same tribe, Dicranolepideae. The only disagreement I have with Domke concerns the placement of the genus *Drapetes* which I believe belongs in the subtribe Daphnopsinae of the Daphneae.

One interesting aspect of my scheme is the lack of genera in the upper right quadrat. I believe this means either that the lateral position of the style evolved after the establishment of the 4-parted calyx or that the 5-parted calyx members have become extinct. The former hypothesis seems to me to be the more probable. The same situation may be true for the development of haplostemony.

Within the genus, subgenus DAPHNOPSIS appears to be more generalized than

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[2] Domke, W. Untersuchungen über die systematische und geographische Gleiderung der Thymelaeaceen. Bibliotheca Bot. 27:1–151. 1934.
[3] Domke, W. ibid. 1934.
[4] Domke, W. ibid. 1934.

subgenus NEIVIRA on the basis of floral morphology. This is suggested by the comparatively wide range of petal and disc types as well as by certain inflorescence patterns found within subgenus DAPHNOPSIS. However, this subgenus also includes the most advanced and the most primitive members of the genus in all other respects save that of inflorescence position. I believe this indicates that subgenus NEIVIRA was derived from a small group of species after the major morphologic variations were established in what is now subgenus DAPHNOPSIS. This ancestral group of species possibly had some of the following characteristics: ability to flower from either the extra-axillary or the axillary position; petals connate into a faucal annulus or absent; disc annular to cupuliform, free.

A key to the currently accepted genera of American Thymelaeaceae has been furnished in the hope that it may be of some practical value and perhaps stimulate interest in the family or in the individual genera.

KEY TO THE AMERICAN GENERA OF THYMELAEACEAE

a. Style terminal; flowers 4- or 5-parted, diplostemonous (except *Schoenobiblus*).
  b. Flowers bisexual (or rarely dioecious?); ovary long-haired; stigma capitate or clavate.
    c. Calyx tube 5-parted, cylindrical; stigma capitate or narrowly clavate; anthers at least short-filamented; inflorescences paniculiform or umbelliform.
      d. Inflorescences paniculiform; calyx tube straight; stigma capitate; leaves opposite. ..... 1. LOPHOSTOMA
      dd. Inflorescences umbelliform; calyx tube straight or curved; stigma capitate or narrowly clavate; leaves alternate.
        e. Calyx tube straight; stigma capitate.....2. LASIADENIA
        ee. Calyx tube more or less curved; stigma narrowly clavate.....3. LINODENDRON
    cc. Calyx tube 4-parted, urceolate; stigma broadly clavate; anthers sessile; inflorescences spiciform or racemiform.....4. LAGETTA
  bb. Flowers dioecious; ovary long-haired, short-haired or glabrous; stigma capitate.
    f. Inflorescences umbelliform to subracemiform; flowers 5-merous; calyx tube orifice with a dense ring of downward pointing hairs; thecae divergent at the base; pistillode reduced to a hairy umbo; ovary long-haired.....5. GOODALLIA
    ff. Inflorescences umbelliform to racemiform; flowers 4-merous; calyx tube orifice glabrous; thecae united at the base; pistillode fusiform, tenpin-shaped or lageniform; ovary long- to short-haired or glabrous.
      g. Inflorescences umbelliform to racemiform; flowers diplostemonous.....6. DAPHNOPSIS
      gg. Inflorescences umbelliform; flowers haplostemonous.....7. SCHOENOBIBLUS
aa. Style lateral; flowers 4-parted; diplostemonous (except *Drapetes*).
  h. Flowers bisexual or rarely dioecious; calyx tube glabrous to short-haired within.
    i. Inflorescences umbelliform; when flowers are diplostemonous the stamens borne at two levels.
      j. Flowers diplostemonous; ovary short-haired or glabrous; small trees or shrubs with alternate macrophyllous leaves; bisexual or dioecious.....8. OVIDIA
      jj. Flowers haplostemonous; ovary puberulent at least towards the apex; dwarf shrubs with decussate microphyllous leaves; bisexual.....9. DRAPETES
    ii. Inflorescences racemiform; flowers diplostemonous, stamens borne at one level.....10. DIRCA
  hh. Flowers dioecious; calyx tube long-haired within.....11. FUNIFERA

THE INFLORESCENCE AND THE FLOWER

Inflorescence: The inflorescence appears to be a highly complicated structure which has been derived from an unknown type. In a typical species of subgenus DAPHNOPSIS, *D. occidentalis*, the vegetative axis is characterized by true dichotomous branching; one of the branches continues as a vegetative axis, the other becomes floriferous. The floriferous axis is extra-axillary and bears no relation to the phyllotaxy; the structure is clearly sympodial. The flowers are in umbelliform

(in this species) to racemiform clusters which are ebracteate and indeterminate.

In *D. americana* both branches resulting from the dichotomy eventually become floriferous. However, the inflorescence is compounded by repeated dichotomies (as many as 9) of which the alternate axes bear a single deciduous bract approximately midway between the subsequent dichotomies. The structure thus formed has the appearance of a cincinnus. The flowers are borne in umbelliform clusters. In this species the resumption of vegetative growth is through the development of axillary buds subtending the first dichotomy.

In another species, *D. philippiana*, the flowers are in an umbelliform cluster which terminates the vegetative axis with the result that the new growth is through the development of the subtending buds. The new growth is either

CONSPECTUS GENERUM

1. Unterfam. Gonystyloideae
2. Unterfam. Aquilarioideae
3. Unterfam. Gilgiodaphnoideae
4. Unterfam. Thymelaeoideae
   1. Tribus: Dicranolepideae
      1. Subtribus: Linostomatinae ..... *Lophostoma*
      2. Subtribus: Dicranolepidinae
   2. Tribus: Phalerieae
   3. Tribus: Daphneae
      1. Subtribus: Wikstroemiinae
      2. Subtribus: Dendrostellerinae
      3. Subtribus: Daphnopsinae ..... *Daphnopsis*
         Funifera
         Schoenobiblus
         Ovidia
         Lagetta
         Dirca
      4. Subtribus: Daphninae
      5. Subtribus: Rhamnoneurinae
   4. Tribus: Gnidieae
      1. Subtribus: Thymelaeinae
      2. Subtribus: Gnidiinae
      3. Subtribus: Passerininae
      4. Subtribus: Kelleriinae
      5. Subtribus: Drapetinae ..... *Drapetes*
      6. Subtribus: Pimeleinae

Anhang: Thymelaeoideae weniger sicheren Anschlusses: *Goodallia*
Linodendron
Lasiadenia

Figure 2. Abstract of Domke's Familial Classification[5]

[5] Domke, W. ibid. 1934.

vegetative or floriferous and, as a result, the inflorescence may be borne from the axillary position. Other species of subgenus DAPHNOPSIS also flower from the axillary position provided that the stem apex is injured or destroyed.

In subgenus NEIVIRA, the inflorescence is always axillary. The flowers are borne in ebracteate umbelliform or racemiform clusters. Typically, the axillary buds become fasciculate by proliferation and remain floriferous for many years. The base of the inflorescence is usually enclosed by a number of prophylls which have been described as bracts but actually are bud scales of the axillary buds.

The flower clusters are always indeterminate and ebracteate. The individual flowers are borne on secondary branches which are sometimes very reduced. An articulation (abscission zone) marks the conclusion of the secondary branch and the beginning of the pedicel and gives evidence that the single flower is all that remains of a cymule. Thus the flower clusters are indeterminate with determinate branches, and therefore thyrses.

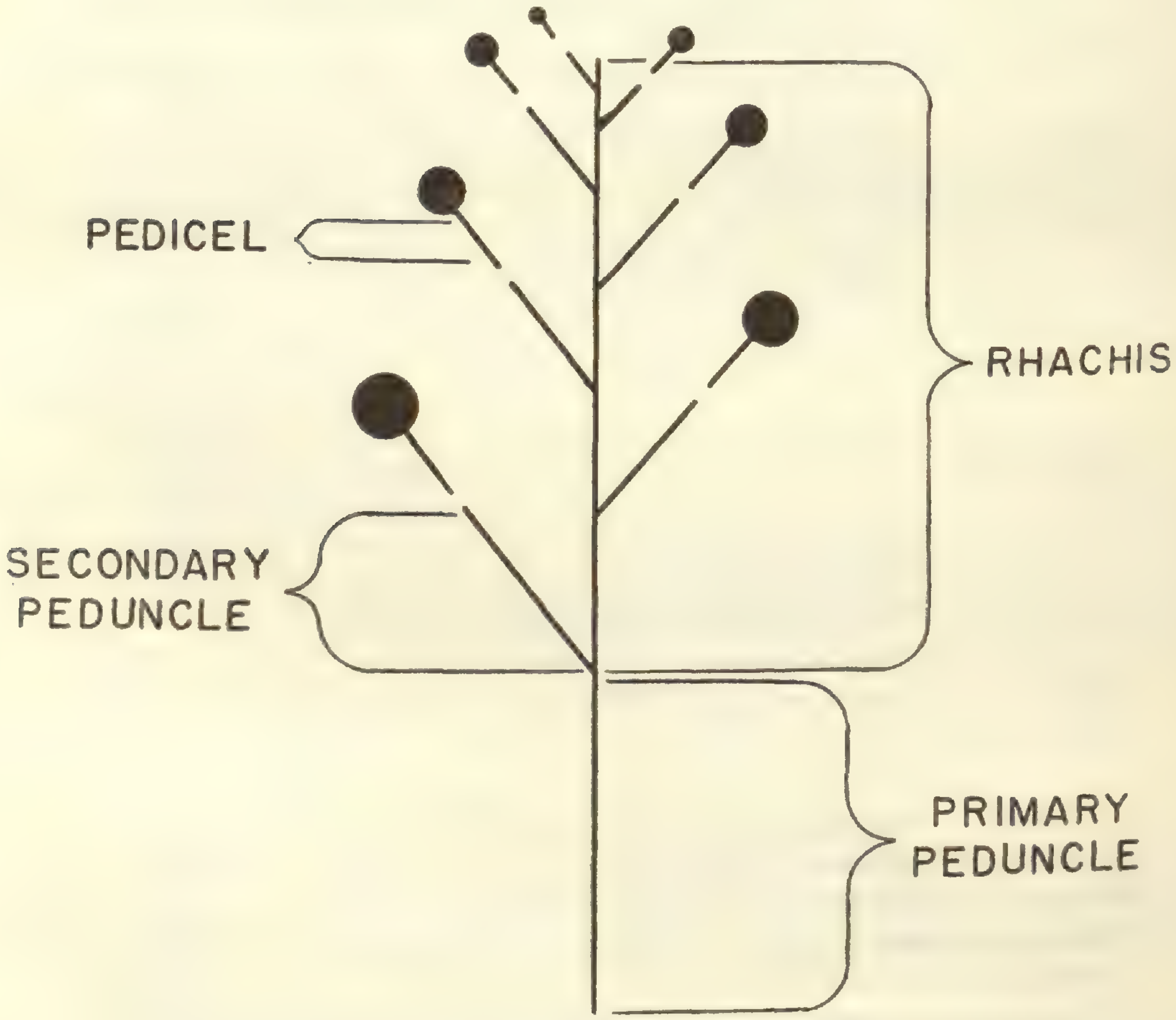

Fig. 3. Structure of the Inflorescence

Terms for the constituent parts of the inflorescence have been used in order to render its organizational structure immediately and easily understood. I have drawn a hypothetical inflorescence (Figure 3) to illustrate the use of the terms employed in this study. The proximal portion of the main axis, from the supporting stem to the first lateral branch, is called the *primary peduncle*; the extension of the main axis, from the first lateral branch to the apex, is termed the *rhachis*. The lateral branches, from the rhachis to the articulation is called the *secondary peduncle*; from the articulation to the expansion of the calyx tube is the *pedicel*.

Considerable variation in the structure of the inflorescence is found within the genus and particularly in subgenus DAPHNOPSIS. As a general rule, the rhachis is rather short throughout this subgenus so that the flowers are in umbelliform clusters. Some examples of species with umbelliform inflorescences and equally developed secondary peduncles and pedicels are *D. occidentalis*, *D. alainii* and *D. brasiliensis*.

In another development of the inflorescence, characterized by *D. punctulata*, *D. monocephala* and *D. pseudosalix*, the secondary peduncles and the pedicels are well-developed but the primary rhachis has elongated to give a subracemiform appearance.

Two other developments characteristic of this subgenus are: development of the pedicel at the expense of the secondary peduncles, exemplified by *D. brevifolia*, *D. perplexa* and *D. flavida* to mention a few; development of the secondary peduncles at the expense of the pedicel, exemplified by *D. liebmannii*, *D. radiata* and *D. ficina*. In *D. purdiei*, *D. mexiae* and *D. equatorialis* the secondary peduncles tend to become connate so as to form a cushion-like structure upon which the flowers are borne.

In subgenus NEIVIRA the species with umbelliform inflorescences are relatively few and are best characterized by *D. sellowiana*. The species with dense racemiform inflorescences are exemplified by *D. beta* and especially *D. espinosae*. In both of these species the secondary peduncles and the pedicels are equally developed. The lax racemiform inflorescence is found in *D. schwackeana*, *D. sanctae-teresae* and *D. racemosa*. In *D. gemmiflora* the inflorescence is lax and racemiform but differs from the preceding group of species in that the flowers lack a noticeable pedicel.

Flower: The flower is dioecious by abortion, regular, tetramerous, perigynous and pedicellate or sessile. It is relatively small and quite inconspicuous in most species but attains a length of about 10 mm. in *D. flavida* and *D. macrocarpa*.

The perianth is always connate into a pronounced tube. There is some dispute as to the presence of a true corolla so that it is difficult to determine what nomenclature should be applied to the tube. I prefer to use the term calyx tube until the nature of the thymelaeaceous flower is more fully understood. The interior of the tube is always glabrous within subgenus DAPHNOPSIS but may be either glabrous or variously pubescent within subgenus NEIVIRA.

The nature of the internal appendages of the tube has been in dispute almost since the foundation of the family. They have been called petals, petaloid glands,

aborted stamens, "effigurations", "enations", "squamellae" and stipules. A concise review of this terminology can be found in an extremely important paper on the floral morphology of the Thymelaeaceae by Katherine Heinig.[6]

In essence, Heinig found that the structures, when isomerous, were enervated by a pair of traces and not a single median trace as customarily would be expected in true petals. Furthermore, in the simplest case, the pair of traces arises one each from the lateral traces of the adjacent calyx lobes. In the case of true petals the median trace would be expected to depart from the commissural traces of the calyx tube. Heinig believes that it is possible to interpret these structures as petals if the petals were considered as much reduced with the midrib lacking, or, if one believes that for some reason the petal midrib failed to depart from the commissural calyx tube traces until after that trace dichotomized to continue, as the calyx lobe laterals. In lieu of this explanation she prefers to interpret the structures as being stipular, her anatomical reasons being obvious.

If we assume that Heinig's interpretation is correct, then the most primitive type is that in which the number of structures is double the number of calyx lobes. From this type it is easy to show progressive cohesion between the lateral margins of the stipules of the adjacent calyx lobes to form structures very similar to the intrapetiolar stipules of the Rubiaceae. This type, in which the structures are isomerous with the calyx lobes, is critical, since those who interpret them as true petals believe the double type to have been formed by progressive apical bifurcation. The only species of *Daphnopsis* with four petals which are large enough to contain vasculature is *D. calcicola*. The petals of this species are reminiscent of those of some species of Combretaceae. From the isomerous type further connation could result in the formation of a faucal annulus, tube or collar. In one species, *D. occidentalis*, the annulus is lobed, the lobes digitiform, alternisepalous and four in number, suggesting origin from the isomerous free type. The final condition is one in which the calyx tube is devoid of any internal appendages. The latter could be derived from any or all of the previous types.

Heinig has pointed out the similarities between the Thymelaeaceae and the case of the floral stipules demonstrated by Woodson and Moore[7] in the Apocynaceae. I am not convinced that these are comparable cases, because: in the Apocynaceae a true corolla occurs which renders the morphology much clearer; in the Apocynaceae the stipules are borne at the base of the calyx tube whereas in the Thymelaeaceae they are borne near the calyx tube orifice; finally, in the Apocynaceae the floral stipules are morphologically similar to the vegetative stipules whereas in the Thymelaeaceae stipules are unknown (Heinig believes that this may indicate an evolutionary lag between the vegetative and reproductive structures).

The term petal is used for the internal calyx appendages throughout this revision. Whether or not these structures are stipular in origin is of little consequence. Petals are known to be of heterogeneous origin (i.e. foliar and andro-

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[6] Heinig, K. Studies In The Floral Morphology Of The Thymelaeaceae, Am. Jour. Bot. 38:113–132. 1951.

[7] Woodson, R. E. Jr., & J. Moore, The vascular anatomy and comparative morphology of apocynaceous flowers. Bull. Torrey Bot. Club 65:135–164. 1938.

ecial) and derivation from stipules remains a possibility. Finally, since the internal calyx structures occupy the same position that petals would be expected to occupy, there seems to be sufficient reason to call them such.

The distribution of petal types in the genus is as follows: subgenus DAPHNOPSIS; petals eight—7 species, petals four—5 species; petals connate into a faucal annulus—10 species, petals absent—12 species; subgenus NEIVIRA; petals connate into a faucal annulus—10 species, petals absent—2 species. Therefore, in subgenus DAPHNOPSIS four petal types are present but in subgenus NEIVIRA only two are found. I believe that this indicates the latter subgenus to be the more specialized.

The antisepalous or outer whorl of stamens gives evidence, by position, that an intervening whorl has been either reduced or lost. Further, in those species having the petals connate into a faucal annulus, the annulus is always above, or outside, both whorls of stamens. This is true even when the antisepalous stamens are inserted on the calyx lobes. The alternisepalous stamens, or inner whorl, are generally inserted somewhat below the antisepalous but appear similar in all other respects. In those species having eight or four petals the alternisepalous stamens are always inserted below the petals which again gives evidence of a lost or reduced whorl.

The pistillate flower may bear reduced androecial parts in the form of staminodia. If staminodia are present, there may be either eight or four and are represented by small papilliform projections near the calyx tube orifice. Six species, some in both subgenera, lack staminodia altogether.

Rarely, as in some plants of *D. americana*, the flowers appear to be functionally bisexual. They bear poorly developed anthers which contain small amounts of pollen; some flowers also set fruit. I have been unable to test either the pollen or fruit for viability.

Domke[8] has reported some functionally masculine plants with flowers in which the ovary contained a relatively well-formed seed. Unfortunately his notes and specimens were destroyed in 1942 and I have been unable to corroborate his observations. Perhaps he was referring to the same phenomenon that I have described in the preceding paragraph.

A recognizable hypogynous disc is found in most species of the genus. The origin of this disc possibly is androecial although there is no irrefutable evidence to demonstrate this. Heinig[9] reports that the disc is vascularized by strands from the radial face of the floral tube bundles or occasionally from the staminal bundles. Some investigators have observed that the disc is generally four-lobate and therefore may represent an inner whorl of aborted stamens. I have found the number, size and position of the disc lobes to be extremely variable and therefore of little value in determining origin. However, I have found in occasional flowers of *D. racemosa* a small portion of the disc displaced from its usual hypogynous position to a point about midway in the calyx tube. I am not certain of the significance of this.

I have assumed the lobate disc to be less advanced than the annular or cupuli-

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[8] Domke, W. op. cit. 1934 and personal correspondence.
[9] Heinig, K. op. cit. 1951.

Fig. 4. Distribution of the Genus and the Subgenera

form types. In addition, I have interpreted the discs which are variously adnate to be more advanced than the free type. In subgenus DAPHNOPSIS the disc ranges from lobate to cupuliform and free to completely adnate. In subgenus NEIVIRA the disc is lobate to cupuliform and always free.

The gynoecium is composed of a single pistil which is of the pseudomonomeric type: the ovary is bicarpellate, one carpel is fertile and the other sterile. The

fertile carpel bears a single pendant ovule on a parietal placenta. The style is terminal, a condition which I consider to be less advanced than a lateral position. The lateral position of the style is obtained by the failure of the sterile carpel to expand.

Geography

The genus is strictly of the New World and is found in Central America, the Antilles and South America. The habitats of the species are quite varied, i.e., from cloud forests to xeric serpentine flats, but the requirements for individual species appear to be rather specific. The plants can be found from sea level to somewhat above 3000 meters and from 24° north latitude to 36° south latitude.

The distribution of the genus and the subgenera is shown in Figure 4. This study has increased the known range of the genus beyond those noted by Domke[10] in 1934, particularly in Central America. This extension is based on various collections made in more recent years. I expect further extension of the range as more collections from South America become available, especially from the eastern slopes of the Andes.

A composite distribution map of the species (Figure 5), although unsatisfactory in many respects, shows several centers about which species tend to be arranged. Subgenus DAPHNOPSIS has two such centers, one in Guatemala and the other in the Greater Antilles. The two appear to be related, a relationship which could have been established sometime between Cretaceous and Miocene when a functional land bridge existed between these two areas. The Antillean center has its greatest development in Cuba where six endemic species are found. The species of this subgenus which has the most extended range is *D. americana*. It occupies roughly an area which approximates the range of the main body of the subgenus.

The species of subgenus NEIVIRA cluster about Rio de Janeiro. The species of this subgenus are generally more restricted than those of subgenus DAPHNOPSIS. *Daphnopsis racemosa*, parallel with *D. americana*, approximates in its range that of the subgenus.

Several important disjunctions occur in *D. americana*, *D. cuneata* and *D. racemosa*, all of which are discussed under those species.

Uses

The genus is of no economic importance so far as I am aware. The fruits are occasionally used as purgatives in some parts of South America. In the Antilles and Central America the fibrous bark is often used as twine or rope.

Special Problems and Materials

Special Problems: The keys to the species of *Daphnopsis* are based primarily on floral morphology. For determining the internal floral characters required by the

[10] Domke, W. op. cit. 1934.

keys, the use of a high-powered dissecting microscope and good illumination is absolutely essential. In most instances the user will profit by examining more than one flower. The species are not all known from both staminate and pistillate material; in fact, six are unknown in staminate material and fourteen are unknown in pistillate material. In addition to this difficulty, seven species are known only

Fig. 5. Composite Distribution Map of the Species of *Daphnopsis*

from a single collection and therefore the keys and descriptions encompass only several specimens at best. The user will discover some necessary omissions and will perhaps find them somewhat disconcerting (but no less so than to the author!). As new material becomes available great care must be taken to match it with existing species which are imperfectly known before new species are described. The distribution of each species is included in the key for the convenience of the user.

The key to subgenus DAPHNOPSIS is based upon petal type. Therefore, I do not regard the key as natural but as indicating four levels of development as characterized by the petals. The species of any level may or may not be related.

In the key to subgenus NEIVIRA I have abandoned the use of petal type as a primary character. If the calyx tube is villous within, the presence or absence of petals is extremely difficult to determine, so that the character is no longer practical.

Each species is represented by an illustration which includes the range as determined by the specimens examined and a sketch of the staminate and pistillate flowers. The background of each figure is one of Goode's Series of Base Maps or portions thereof supplied by the University of Chicago Press. The symbols represent approximate localities where specimens were collected and do not in any way reflect the relative abundance of the species; any symbol may represent from one to many collections. The drawings of the flowers have been made to the same scale throughout, about $\times 9$ natural size. They are semi-diagrammatic in order to clarify certain internal morphologic characters and to expedite the use of the keys.

Karl Daniel Friedrich Meissner (1800–1874): In the course of compiling species and synonym citations I became involved in a rather curious problem in orthography. Since my first realization of this problem I have found the confusion to be so widespread that a short note about it may not be out of order.

The problem involves the orthography of the name of one of the most active workers in the genus, Karl Daniel Friedrich Meisner (or Meissner). His name, as author, appears with both spellings in about equal numbers. Annotations of herbarium specimens in his handwriting are generally Msn.—an unfortunate state of affairs for one interested in orthography! These specimens are now in the possession of the New York Botanical Garden and are stamped "Meisner Herbarium". According to the Barnhart Biographical Index of Botanists, which is also owned by the New York Botanical Garden, " . . . his father spelled the name Meisner and so did the son in his youth." In addition, an article in the Journal of Botany (12:191. 1874) begins, "Karl Friedrich Meisner, or, as he recently spelt his name, Meissner . . . " Furthermore, in an obituary by Asa Gray,[11] the question of orthography is raised and he says, "In the family circular announcing his decease it is Meissner." Finally, I have obtained a copy of his death certificate from Basel and the spelling is Meissner.

An excellent biographical sketch by Alphonse de Candolle[12] reveals the under-

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[11] Gray, A. in Bull. Torrey Bot. Club 5:25. 1874.

[12] de Candolle, A. Notice Biographique Sur Charles-Frederic Meissner in Bull. Soc. Bot. Fr. 21: 279–283. 1874.

lying reason for the change in orthography. The son, with whom we are concerned, was apparently afraid that he might be confused with his illustrious father and wishing to avoid confusion chose to spell his name Meissner. In retrospect, there was little basis for his fear, as his father's works were confined to zoology and geography, fields in which the son never published. In attempting to avoid confusion he actually created it! I am using the spelling Meissner.

Materials: This revision is based on specimens from the following herbaria. The abbreviations for them are taken from Lanjouw & Stafleu's 'Index Herbariorum' part I (Regnum Vegetabile, vol. 15, 4th ed., 1959).

A	—Arnold Arboretum, Harvard University, Cambridge
B	—Botanisches Museum, Berlin-Dahlem
BM	—British Museum, London
C	—Botanical Museum and Herbarium, Copenhagen
F	—Chicago Natural History Museum, Chicago
GH	—Gray Herbarium of Harvard University, Cambridge
IAN	—Instituto Agronómico do Norte, Belém
IPA	—Instituto de Pesquisas Agronômicas, Dois Irmaõs, Recife
K	—Herbarium Royal Botanic Gardens, Kew
LS	—"Herbario de la Salle", Colegio de la Salle, Habana
M	—Botanische Staatssammlung, München
MA	—Instituto "Antonio José Cavanilles", Madrid
MICH	—University Herbarium, University of Michigan, Ann Arbor
MO	—Missouri Botanical Garden, St. Louis
NY	—The New York Botanical Garden, New York
P	—Muséum National d'Histoire Naturelle, Paris
PACA	—Herbarium Anchieta, Colegio Anchieta, Porto Alegre
R	—Divisão de Botânica do Museu Nacional, Rio de Janeiro*
RB	—Jardim Botânico, Rio de Janeiro
S	—Botanical Department, Naturhistoriska Riksmuseum, Stockholm
U	—Botanical Museum and Herbarium, Utrecht
US	—U. S. National Museum, Smithsonian Institution, Washington
W	—Naturhistorisches Museum, Wien

I wish to take this opportunity to thank the curators and the directors of the above herbaria for the many courtesies extended to me. I wish to thank, particularly, Bro. Alain F.S.C. of Colegio de la Salle, the Rev. B. Rambo S.J. of Colegio Anchieta and H. Moreira Filho of the Instituto de História Natural, Curitiba, for their gracious gifts of duplicate specimens to the Missouri Botanical Garden.

In addition to the usual method of citing the specimen and the institution to which it belongs I have also cited the sex of each specimen. The citation for each collection is opened and closed with brackets; within the brackets the applicable herbarium abbreviations are used in alphabetical order; following each herbarium abbreviation is the notation of the sex of that specimen, which is enclosed by a set of parentheses. When all examined specimens of a collection are of the same sex, the symbol precedes the herbarium abbreviations, and is not repeated. The sex citation is abbreviated in four categories (♂) for staminate; (♀) for pistillate; (s) for sterile; and (?) for specimens in which the flowers are too immature to diagnose or in which the old inflorescences are present but lack flowers or fruit.

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* Specimens received too late for the information to be incorporated into the figures.

Taxonomy

Daphnopsis Mart. & Zucc. Nov. Gen. & Sp. 1:65. 1824. [T.: *D. brasiliensis* Mart. & Zucc.]

Bosca Velloso, Flor. Flumin. 142, 1881; Icon 4, *t. 11.* 1827. [T.: *B. stupacea* Velloso]
Gastrilia Raf. Flor. Telluriana 4:105. 1836. [T.: *G. umbellata* Raf. based on *Daphne occidentalis* Sw.]
Nordmannia Fisch. & C. A. Mey. in Bull. Acad. St. Petersbourg 1:355. 1843; Ann. Sci. Nat. ser. II. 20:49. 1843. [T.: *N. tinifolia* (Sw.) Fisch. & C. A. Mey.]
Hargasseria Schiede & Deppe, ex C. A. Mey. in Bull. Acad. St. Petersbourg 1:356. 1843; Ann. Sci. Nat. ser. II. 20:51. 1843. [T.: *H. mexicana* Schiede & Deppe, ex C. A. Mey. based on *Daphne bonplandiana* Cham. & Schlechtd. not HBK.]
Coleophora Miers, in Ann. Nat. Hist. ser. II. 7:196. 1851. [T.: *C. gemmiflora* Miers]
Hyptiodaphne Urb. Symb. Ant. 2:453. 1901. [T.: *H. crassifolia* (Poir.) Urb.]

Shrubs or trees, usually with soft wood and leathery flexible branches, the stems unequally dichotomous or monopodial, the bark more or less longitudinally rugose after drying. Leaves spiral or approximately whorled by irregular condensation, simple, pinnately veined, estipulate. Inflorescences borne from the younger leafy or bracteate stems or on axillary brachyblasts from the younger or older defoliated nodes and sometimes becoming fasciculate there, umbelliform, racemiform or rarely the flowers solitary. Flowers dioecious, tetramerous, perigynous; calyx tube obconic to urceolate or campanulate, more or less inconspicuously ribbed, generally greenish-yellow, often densely hairy without; calyx lobes subequal or unequal, imbricate, the outer ovate-trigonal, often bearing a small exterior median horn below the apex, slightly cucullate becoming reflexed and everted at anthesis, the inner ovate-suborbicular, plane; petals minute, 8, 4, connate into an obscure faucal annulus or absent, generally papilliform or squamelliform, inserted on the calyx tube in the alternisepalous position; disc of free lobes or annular to cupuliform or tubular and free to adnate, with entire to variously lobed margins, sometimes absent. Staminate flowers: stamens 8, in two whorls inserted at two levels, the upper antisepalous, the lower alternisepalous, the anthers sessile, subsessile or filamented, basifixed, longitudinally dehiscent, introrse; pistillode lageniform to tenpin-shaped. Pistillate flowers: generally somewhat smaller than the staminate; staminodia 8, 4 or absent, generally papilliform; pistil 1, pseudomonomeric, superior, borne on a short to long gynophore, containing a single pendulous ovule upon the parietal placenta, the style terminal, the stigma capitate, sometimes obscurely bilobed. Fruit a small drupe; seed exalbuminous or nearly so, the embryo minute, the cotyledons thick, convex; calyx tube partially or completely persistent at the base.

KEY TO THE SUBGENERA

a. Branching truly or falsely dichotomous, the false dichotomies (result of terminal flowering or injury) with persistent or deciduous cataphylls at their bases; inflorescences extra-axillary from the young leafy or bracteate stems or on axillary brachyblasts, umbelliform, racemiform or rarely the flowers solitary and pedunculate; calyx tube glabrous within; petals 8, 4, connate into an obscure faucal annulus or absent; disc of discrete lobes, annular, cupuliform, tubular, or absent, free to adnate.....I. DAPHNOPSIS (p. 272)

aa. Branching monopodial or falsely dichotomous, the false dichotomies (result of injury) with persistent or deciduous cataphylls at their bases; inflorescences borne from axillary brachyblasts at the young leafy to old defoliated nodes and often becoming fasciculate there, dense to lax racemiform or rarely the flowers solitary and sessile; calyx tube glabrous to villous within; petals connate into an obscure faucal annulus or absent; disc of discrete lobes, annular to cupuliform, free.....II. NEIVIRA (p. 333)

SUBGENUS I. DAPHNOPSIS

Section *Nordmannia* Benth. & Hook. Gen. Pl. 3:191. 1883.

KEY TO THE SPECIES

a. Staminate flowers with petals, the disc of lobes (and free), annular (and free or basally adnate) or cupuliform (and free or basally adnate); pistillate flowers with petals, the staminodia 8, 4 or 0, the disc of lobes (and free) or annular (and free to completely adnate).

b. Staminate flowers with 8 or 4 free petals, the disc of lobes (and free) or annular (and free or basally adnate); pistillate flowers with 8 or 4 free petals, the staminodia 8 or 0, the disc of lobes (and free) or annular (and basally to completely adnate).

c. Staminate flowers with 8 free petals, the disc of lobes (and free) or annular (and free or basally adnate); pistillate flowers with 8 free petals, the staminodia 8, the disc of lobes (and free) or annular (and basally to completely adnate), the stigma exserted.

d. Leaf apex obtuse, acute or attenuate-acuminate; calyx lobes indefinitely papillate or puberulent within; staminate flowers with the disc of lobes (and free) or annular (and free or basally adnate); pistillate flowers with the disc of lobes (and free) or annular (and basally adnate).

e. Calyx lobes indefinitely papillate or puberulent within; staminate flowers with the anthers sessile or subsessile, included or only the antisepalous exserted, the pistillode glabrous or minutely pilose at the apex; pistillate flowers with the ovary glabrous or minutely pilose, the stigma capitate.

f. Calyx lobes indefinitely papillate within; staminate flowers with the anthers sessile, the disc of lobes (and free) or annular (and free); pistillate flowers with the disc of lobes (and free) or annular (and basally adnate), irregularly lobed or undulate to entire.

g. Primary lateral veins of the leaves almost parallel with the costa; staminate flowers with the disc of lobes (and free), the pistillode minutely pilose at the apex; pistillate flowers with the disc of lobes (and free), the ovary minutely pilose at the apex. Plants of Hispaniola.....1. D. HISPANIOLICA

gg. Primary lateral veins of the leaves forming an angle of at least 30 degrees with the costa; staminate flowers with the disc of lobes (and free) or annular (and free), the pistillode glabrous; pistillate flowers with the disc annular (and basally adnate), the ovary glabrous.

h. Staminate flowers with the calyx tube narrowly obconic to tubular, 6–7 mm. long, the disc of several lobes (and free), the pedicel 2.5–3.5 mm. long; pistillate flowers not seen. Plants of Colombia.....2. D. PURDIEI

hh. Staminate flowers with the calyx tube campanulate to obconic, 2.0–5.5 mm. long, the disc annular (and free), irregularly and deeply lobed, the pedicel 0.5–1.0 mm. long; pistillate flowers with the calyx tube campanulate to nearly urceolate, 2–3 mm. long, the disc annular (and basally adnate), irregularly lobed or undulate to entire.

i. Staminate flowers less than 30 per inflorescence, the calyx tube campanulate, 2.0–3.5 mm. long, the pistillode lageniform; pistillate flowers with the disc irregularly lobed. Plants of Colombia and Venezuela.....3. D. CARACASANA

ii. Staminate flowers 35–55 per inflorescence, the calyx tube narrowly obconic, 4.5–5.5 mm. long, the pistillode tenpin-shaped; pistillate flowers with the disc undulate to entire. Plants of Ecuador.....4. D. MACROPHYLLA

ff. Calyx lobes puberulent within; staminate flowers with the anthers sessile or subsessile, the disc annular (and basally adnate); pistillate flowers not seen. Plants of Mexico.....5. D. PURPUSII

ee. Calyx lobes puberulent within; staminate flowers with the anthers long-filamented, both whorls exserted, the pistillode setose; pistillate flowers with the ovary setose, the stigma minutely capitate. Plants of Mexico.....6. D. MOLLIS

dd. Leaf apex acuminate; calyx lobes puberulent within; staminate flowers not seen; pistillate flowers with the disc annular (and completely adnate). Plants of Mexico.....7. D. PERPLEXA

cc. Staminate flowers with 4 free petals, the disc of lobes (and free); pistillate flowers with 4 free petals, the staminodia 8 or 0, the disc of lobes (and free) or annular (and free), the stigma exserted or included.

j. Leaves darker above than below, with the primary lateral veins forming an angle of at least 30 degrees with the costa; calyx lobes indefinitely papillate within; pistillate flowers with 8 staminodia.

k. Staminate flowers with the disc of lobes (and free), the pistillode glabrous, the pedicel about 0.5 mm. long; pistillate flowers not seen.

l. Staminate flowers with the calyx tube 3.0–3.5 mm. long, the petals digitiform, longer than broad, the disc short-lobate, the anthers 0.5–0.75 mm. long. Plants of Guatemala.....8. D. MONOCEPHALA

ll. Staminate flowers with the calyx tube 5–6 mm. long, the petals squammelliform, about as long as broad, the disc lobes almost as tall as the pistillode, the anthers about 1.5 mm. long. Plants of Puerto Rico.....9. D. HELLERIANA

kk. Staminate flowers not seen; pistillate flowers with the disc annular (and free), the ovary pilose toward the apex, the pedicel about 4.5 mm. long. Plants of Ecuador.....10. D. EQUATORIALIS

jj. Leaves essentially the same color above and below, the primary lateral veins almost parallel with the costa; calyx lobes puberulent within; pistillate flowers with 8 or 0 staminodia.

m. Staminate flowers with the petals papilliform, less than 0.25 mm. long, glabrous, the pistillode minutely setose; pistillate flowers with the petals papilliform, less than 0.25 mm. long, glabrous, the ovary minutely setose, the staminodia 8. Plants of central Cuba.....11. D. OBLONGIFOLIA

mm. Staminate flowers not seen; pistillate flowers with the petals obovate, about 0.75 mm. long, tomentose, the ovary minutely setose, the staminodia 0. Plants of western Cuba.....12. D. CALCICOLA

bb. Staminate flowers with the petals connate into an obscure faucal annulus, with or without 4 prominent alternisepalous lobes, the disc of lobes (and free), annular (and free or basally adnate) or cupuliform (and free or basally adnate); pistillate flowers with the petals connate into an obscure faucal annulus, with or without 4 prominent alternisepalous lobes, the staminodia 8, 4, or 0, the disc of lobes (and free), annular (and free to completely adnate) or cupuliform (and basally adnate).

n. Calyx lobes indefinitely papillate within; faucal annulus with 4 prominent alternisepalous lobes. Plants of Jamaica.....13. D. OCCIDENTALIS

nn. Calyx lobes indefinitely papillate or puberulent within; faucal annulus without 4 prominent alternisepalous lobes.

o. Staminate flowers with the disc of lobes (and free) or cupuliform (and free), irregularly lobed, the pistillode minutely setose; pistillate flowers with the disc of lobes (and free) or annular (and basally adnate), the staminodia 4 or 8.

p. Staminate flowers 4–8 per inflorescence, the anthers oblong, the disc of lobes (and free), the pistillode tenpin-shaped, the pedicel obsolete; pistillate flowers with the disc of lobes (and free), the staminodia 4, the pedicel about 1 mm. long. Plants of Mexico.....14. D. LIEBMANNII

pp. Staminate flowers 2–55 per inflorescence, the anthers suborbicular, the disc cupuliform (and free), the pistillode lageniform, the pedicel 3–4 mm. long; pistillate flowers with the disc annular (and basally adnate), the staminodia 8, the pedicel 3–5 mm. long. Plants of Mexico.....15. D. MEXIAE

oo. Staminate flowers with the disc of lobes (and free), annular (and free to completely adnate) or cupuliform (and basally adnate), irregularly lobed, undulate or entire, the pistillode glabrous; pistillate flowers with the disc of lobes (and free), annular (and free to completely adnate) or cupuliform (and basally adnate), the staminodia 0 or 8.

q. Calyx lobes indefinitely papillate within; staminate flowers with the disc of lobes (and free), annular (and free to basally adnate) or cupuliform (and basally adnate); pistillate flowers with the disc of 4 lobes (free), annular (and free) or cupuliform (and basally adnate).

r. Leaves alternate; staminate flowers puberulent without, the disc annular (and free); pistillate flowers puberulent without, the disc annular (and free). Plants of Cuba.....16. D. GUACACOA

rr. Leaves approximately whorled; staminate flowers sericeous or hirsute without, the disc of irregular lobes (and free) or cupuliform (and basally adnate); pistillate flowers sericeous or hirsute without, the disc of 4 lobes (and free) or cupuliform (and basally adnate).

s. Staminate flowers with the calyx tube 9–10 mm. long, hirsute without, the disc of irregular lobes (and free); pistillate flowers with the calyx tube tubular, about 6.5 mm. long, hirsute without, the disc of 4 lobes (and free), the stigma included. Plants of Hispaniola.....17. D. CRASSIFOLIA

ss. Staminate flowers with the calyx tube 3.5–6.5 mm. long, sericeous without, the disc cupuliform (and basally adnate); pistillate flowers with the calyx tube suburceolate, about 3.5 mm. long, sericeous without, the disc cupuliform (and basally adnate), the stigma exserted. Plants of Puerto Rico.....18. D. PHILIPPIANA

qq. Calyx lobes puberulent within; staminate flowers with the disc annular (and basally to completely adnate) or cupuliform (and basally adnate); pistillate flowers with the disc annular (and free to completely adnate).

t. Staminate flowers with the antisepalous stamens subexserted, the alternisepalous included, the disc annular (and free), the pistillode glabrous; pistillate flowers with the disc annular (and free), the stigma exserted.

u. Staminate flowers 15–50 per inflorescence, the calyx tube subcampanulate to campanulate, tomentose without, the pistillode bottle-shaped; pistillate flowers 2–5 per inflorescence, the calyx tube campanulate, tomentose without. Plants of Brasil.....19. D. BRASILIENSIS

uu. Staminate flowers 2–4 per inflorescence, the calyx tube obconic, puberulent without, the pistillode tenpin-shaped; pistillate flowers not seen. Plants of Cuba.....20. D. ANGUSTIFOLIA

tt. Staminate flowers with the antisepalous stamens subexserted to exserted, the alternisepalous included to subexserted, the disc annular (and basally to completely adnate) or cupuliform (and basally adnate), the pistillode glabrous or minutely setose at the apex; pistillate flowers with the disc annular (and basally to completely adnate) or cupuliform (and basally to completely adnate), the stigma exserted or included.

v. Staminate flowers with the alternisepalous stamens included, the disc annular (and basally adnate), entire, the pistillode glabrous; pistillate flowers with the disc annular (and completely adnate), the staminodia 0, the stigma exserted; inflorescences always simple. Plants of Cuba and Hispaniola.....21. D. CUNEATA

vv. Staminate flowers with the alternisepalous stamens included to subexserted, the disc annular to cupuliform (and basally to completely adnate), irregularly short-lobed, the pistillode glabrous or minutely setose at the apex; pistillate flowers with the disc annular to cupuliform (and basally to completely adnate), the staminodia 8, often with poorly developed anthers, the stigma exserted or included; inflorescences simple or more often 2–8 times dichotomous. Plants of Central America, Antilles, northern and northwestern South America.....22. D. AMERICANA

aa. Staminate flowers lacking petals, the disc annular (and free to completely adnate) or cupuliform to tubular (and free); pistillate flowers lacking petals, the staminodia 8, the disc annular (and free or completely adnate).

w. Staminate flowers with the disc annular (and free) or cupuliform to tubular (and free); pistillate flowers with the disc annular (and free).

x. The disc regularly or irregularly but conspicuously lobed (some of the lobes to ⅓ the height of the disc), the staminate cupuliform (and free), the pistillate annular (and free).

y. Calyx lobes indefinitely papillate within; staminate flowers with the disc regularly 4-lobed, the pistillode glabrous, the pedicel about 5 mm. long; pistillate flowers not seen. Plants of Mexico.....23. D. FLAVIDA

yy. Calyx lobes indefinitely papillate or puberulent within; staminate flowers with the disc irregularly lobed, the pistillode hirtellous, the pedicel 0.5–1.0 mm. long; pistillate flowers with the disc annular (and free) and irregularly lobed.

z. Staminate flowers with the calyx tube tubular, about 10.5 mm. long, the calyx lobes puberulent within, the pistillode hirtellous; pistillate flowers not seen; drupe ellipsoid, to 3 cm. long, 1 cm. in diameter. Plants of Santa Lucia...24. D. MACROCARPA

zz. Staminate flowers not seen; pistillate flowers with the calyx tube urceolate, 2.0–2.5 mm. long, the calyx lobes indefinitely papillate within, the ovary glabrous; drupe not seen. Plants of Cuba.....25. D. ALAINII

xx. The discs undulate to entire, the staminate annular (and free to completely adnate), cupuliform (and free) or tubular (and free), the pistillate annular (and free).

A. Calyx lobes indefinitely papillate within; staminate flowers with the disc nearly as long as the pistillode, the pistillode glabrous; pistillate flowers not seen. Plants of Peru.....26. D. PAVONII

AA. Calyx lobes indefinitely papillate or puberulent within; staminate flowers with the disc much shorter than the pistillode, the pistillode glabrous or setose; pistillate flowers with the disc annular (and free), the ovary glabrous or setose.

B. Leaves narrowly elliptic; calyx lobes puberulent within; staminate flowers with the calyx tube narrowly campanulate, about 2 mm. long, the disc annular (and free), entire, the pistillode glabrous; pistillate flowers not seen. Plants of Brasil.....27. D. PSEUDOSALIX

BB. Leaves elliptic to broadly elliptic or oblanceolate; calyx lobes puberulent or glabrous within; staminate flowers with the calyx tube campanulate to tubular, 5–8 mm. long, the disc cupuliform (and free) or tubular (and free), undulate, the pistillode setose. Pistillate flowers with the disc annular (and free).

C. Leaves elliptic to oblanceolate; calyx lobes minutely puberulent within; staminate flowers with the calyx tube obconic, 5–6 mm. long, the disc cupuliform (and free); pistillate flowers with the pistil lageniform, the ovary setose. Plants of Colombia.....28. D. ANOMALA

CC. Leaves elliptic; calyx lobes glabrous within; staminate flowers with the calyx tube campanulate to tubular, 6–8 mm. long, the disc cupuliform (and free) or tubular (and free); pistillate flowers with the pistil tenpin-shaped, the ovary setose or glabrous.

D. Staminate flowers with the disc tubular (and free), about 1.5 mm. tall, irregularly undulate, the pistillode borne on a gynophore about 1 mm. long; pistillate flowers with the disc annular (and free), the ovary glabrous; drupe glabrous. Plants of Guatemala.....29. D. RADIATA

DD. Staminate flowers with the disc cupuliform (and free), about 0.5 mm. tall, more or less undulate, the pistillode sessile or essentially so; pistillate flowers with the disc annular (and free), the ovary setose; drupe minutely setose at the apex.

E. Inflorescences borne terminally on the young leafy stems; staminate inflorescence with the primary peduncle 0.5–1.0 mm. long, the secondary peduncles about 0.5 mm. long; pistillate inflorescence with the primary peduncle about 7 mm. long; staminate flowers with the calyx tube 6–8 mm. long, the pedicel 0.5–2.0 mm. long; pistillate flowers not seen. Plants of Guatemala.....30. D. TUERCKHEIMIANA

EE. Inflorescences borne terminally on the young leafy stems or sometimes on axillary brachyblasts; staminate inflorescence with the primary peduncle about 10 mm. long, the secondary peduncles 1–5 mm. long; pistillate inflorescence with the primary peduncle 10–50 mm. long; staminate flowers with the calyx tube 6.0–6.5 mm. long, the pedicel about 0.5 mm. long; pistillate flowers with the disc annular (and free), the ovary setose; drupe minutely setose at least at the apex. Plants of Guatemala and El Salvador.....31. D. SELERORUM

WW. Staminate flowers with the disc annular (and basally to completely adnate); pistillate flowers with the disc annular (and completely adnate).

F. Staminate flowers with the disc annular (and basally adnate), the anthers filamented, both whorls exserted, the pistillode setose; pistillate flowers not seen. Plants of Mexico.....32. D. BREVIFOLIA

FF. Staminate flowers with the disc annular (and basally or completely adnate), the anthers sessile, the antisepalous subexserted to exserted, the alternisepalous included, the pistillode glabrous; pistillate flowers with the disc annular (and completely adnate), the ovary glabrous.

G. Young branches minutely black-punctate; staminate inflorescence with the secondary peduncles to 1 mm. long; staminate flowers with the calyx lobes indefinitely papillate within, the pedicel about 1.5 mm. long; pistillate flowers not seen. Plants of Cuba.....33. D. PUNCTULATA

GG. Young branches minutely puberulent; staminate inflorescence with the secondary peduncles 2–12 mm. long; staminate flowers with the calyx lobes puberulent within, the pedicel obsolete; pistillate inflorescence with the secondary peduncle 2–6 mm. long; pistillate flowers with the calyx lobes puberulent within, the pedicel about 0.5 mm. long. Plants of Mexico and Guatemala.....34. D. FICINA

1. DAPHNOPSIS hispaniolica Nevl. spec. nov.

Frutices vel arbores parvi; ramis juvenibus pubescentibus usque glabrescentibus. Folia lineari-oblonga usque oblonga vel oblongo-elliptica 1–11 cm. longa 0.3–1.25 cm. lata apice acuta usque mucronulata basi cuneata coriacea glabra, venis primariis

lateralibus paene costa parallelis; petiolo 1–5 mm. longo. Inflorescentia mascula umbelliformis; pedunculo primario 2–3(–15) mm. longo; rhachide ca. 0.5 mm. longo; pedunculis secundariis ca. 1 mm. longis. Flores masculi 2–4(–7) per inflorescentia; pedicello 1 mm. longo; calyce obconico 2–4 mm. longo 1.5 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus glabris 1.5 mm. longis 1.25–1.5 mm. latis; petalis 8 papilliformibus; staminibus in planis 2, antheris oblongis 0.5–0.75 mm. longis 0.5 mm. latis sessilibus; disco humili lobato libero glabro; pistillodio lageniformi 0.5–0.75 mm. longo pubescente. Inflorescentia feminea umbelliformis; pedunculo primario 1.0–1.5 mm. longo; rhachide ca. 0.5 mm. longo; pedunculis secundariis ca. 0.5 mm. longis. Flores feminei 2–6 per inflorescentia; pedicello 1–2 mm. longo; calyce campanulato 1 mm. longo 0.5–0.75 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus glabris 0.75–1.0 mm. longis 0.5–0.75 mm. latis; petalis 8 papilliformibus; staminodiis 8 papilliformibus; disco humili lobato libero glabro; pistillo 2 mm. longo ovario ovato superne minute piloso stigmate capitato exserto. Fructus ellipticus 1.0–2.4 cm. longus 5–8 mm. latus. HOLOTYPUS: *Ekman H4947* (A).

Found on limestone bluffs from 400 to 900 meters. Flowers from February to September.

Fig. 6. *Daphnopsis hispaniolica*

DOMINICAN REPUBLIC: AZUA: Sierra de Ocoa, San José de Ocoa, Loma Miguel-Martin, Subida de las Canas, *Ekman H11957* [(♀) S, US].

HAITI: ARTIBONITE: Ennery, *Ekman H2451* [S (s)]; hills w. of Glore, on Étang Laumâtre, *Ekman H1063* [(♂) S. US]. QUEST: Massif de la Selle, Morne Dumaisin, *Ekman H3071* [S (?)]. NORD: Gros-Morne, Morne Bonsjére, *Ekman H4947* [(♂) A, NY, S, US], *H4957* [(♀) S, US].

This new species has the same general appearance as *D. oblongifolia* and has been mistaken for it. The internal floral structure clearly shows that these two species are not related.

2. DAPHNOPSIS PURDIEI Meissn. in DC. Prod. 14:522. 1857. [T.: *Purdie s. n.* (♂)!]

Trees, the young branches ochraceous-tomentose and glabrescent. Leaf blades oblanceolate to elliptic, 5–14 cm. long, 1.5–4.5 cm. broad, acute at the apex, attenuate-cuneate at the base, subcoriaceous, tomentose or glabrescent above, appressed-tomentose below, the costa immersed above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 4–8 mm. long. Inflorescences borne from the young leafy or bracteate stems, umbelliform, tomentose, the primary peduncle 2.8–5.5 cm. long, the rhachis to 5 mm. long, the secondary peduncles 1–3 mm. long. Staminate flowers: 25–55 per

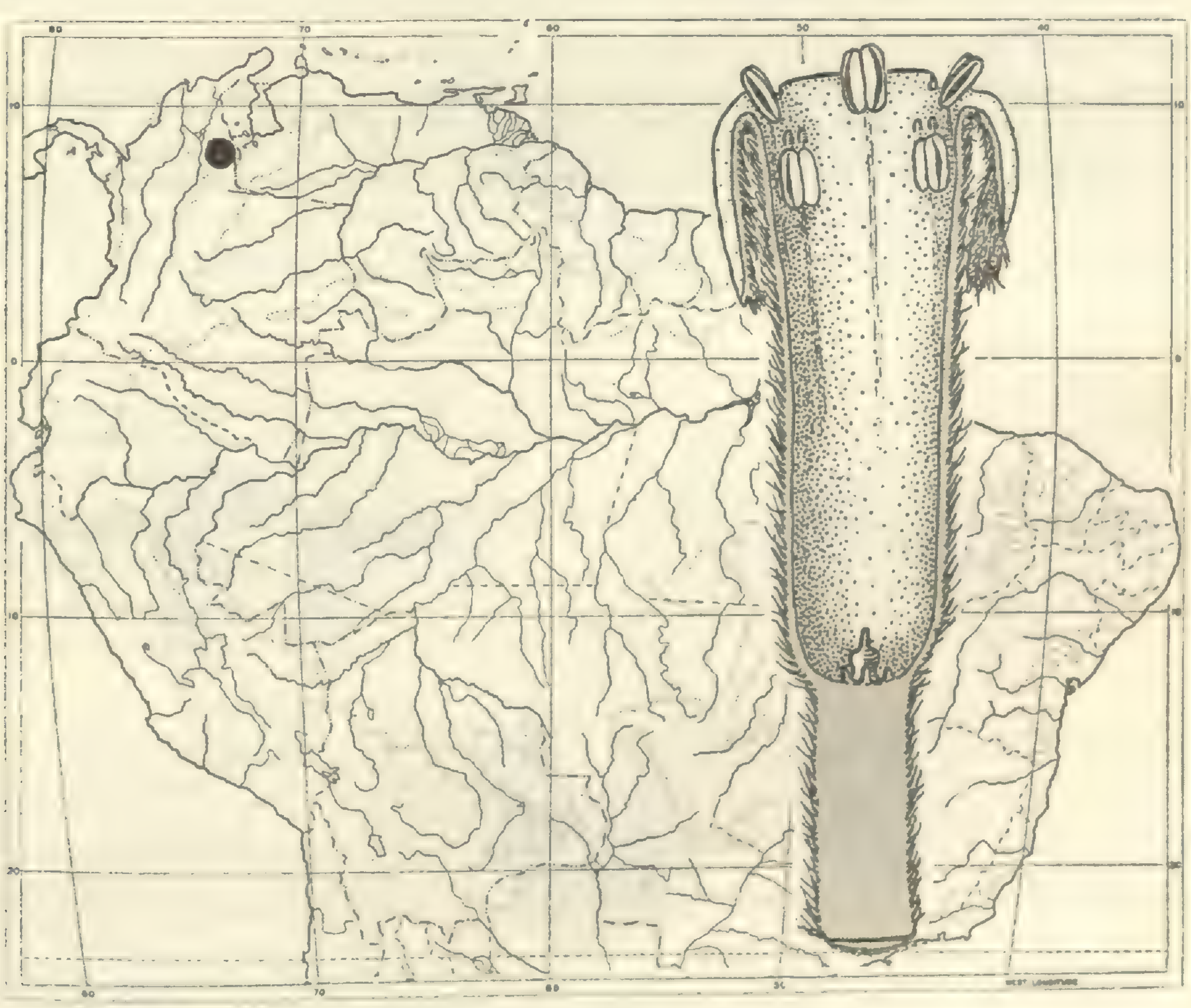

Fig. 7. ***Daphnopsis purdiei***

inflorescence; pedicel 2.5–3.5 mm. long; calyx tube narrowly obconic to nearly tubular, 6–7 mm. long, 1.75–2.5 mm. broad at the orifice, tomentose without, glabrous within; calyx lobes subequal, indefinitely papillate within, about 2 mm. long, 1.5 mm. broad; petals 8, papilliform, approximately 0.25 mm. long, inserted immediately above the alternisepalous stamens; antisepalous stamens inserted at the orifice, exserted, the alternisepalous inserted two anthers' lengths below the orifice, included, the anthers oblong, about 0.75 mm. long, 0.5–0.75 mm. broad, sessile; disc of several small free lobes, glabrous; pistillode lageniform, about 0.75 mm. long, glabrous. Pistillate flowers and fruit not seen.

COLOMBIA: NORTE DE SANTANDER: Ocaña, *Purdie s. n.* [(♂) A, F, K, NY, US].

According to Purdie this tree is known as *ahousita.* The sap is supposedly caustic, causing blisters and much pain.

Meissner based his description of this species on a specimen in the Arnott Herbarium and presumably this specimen is now on deposit at Glasgow. He also retained a fragment of this specimen for his personal herbarium which is now on deposit at New York.

This species seems to be closely related to *D. caracasana* Meissn. and *D. macrophylla* (HBK.) Gilg.

3. DAPHNOPSIS CARACASANA Meissn. in DC. Prod. 14:521. 1857. [T.: *Karsten 211* (♀)!]

Daphne caracasana Klotzsch, ex Meissn. loc. cit. 1857, as syn.
Daphnopsis bogotensis Meissn. loc. cit. 1857. [T.: *Hartweg 1366* (♀)!]

Shrubs or trees to 6 m. tall, the young branches ochraceous-tomentose. Leaf blades obovate to oblanceolate 3–8(–14) cm. long, 1–4(–6.5) cm. broad, obtuse to subacute at the apex, cuneate to obtuse at the base, subcoriaceous, sericeous and

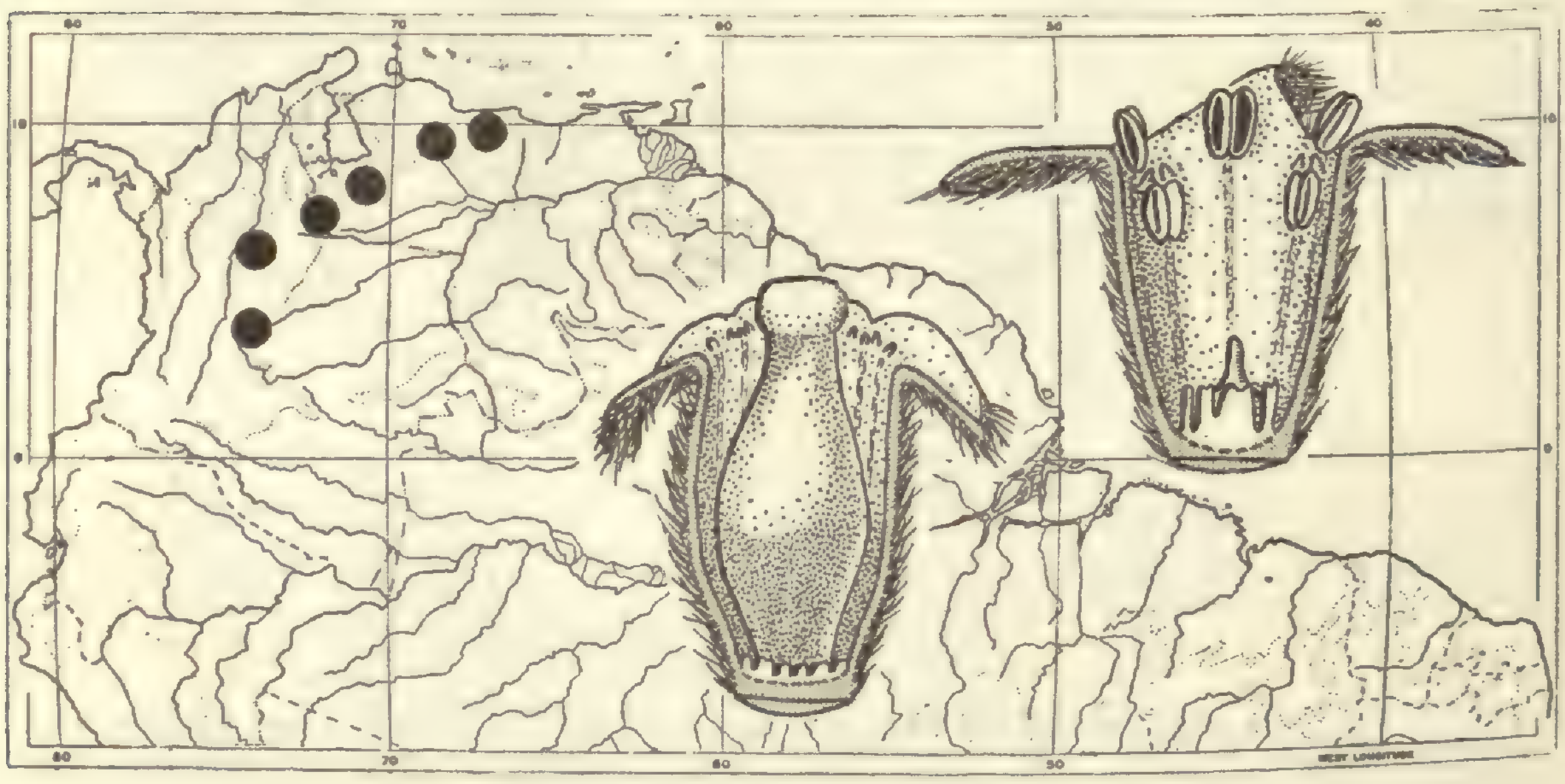

Fig. 8. *Daphnopsis caracasana*

glabrescent above and below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 3–4 mm. long. Inflorescences borne from the young leaf stems, umbelliform, sericeous, the primary peduncle 0.7–4.0 cm. long, the rhachis 1–3 mm. long, the secondary peduncles 2–4 mm. long. Staminate flowers: 15–30 per inflorescence; pedicel about 0.5 mm. long; calyx tube campanulate, 2.0–3.5 mm. long, 1.5–2.0 mm. broad at the orifice, sericeous without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer 2.0–2.5 mm. long, about 1 mm. broad, the inner about 1.5 mm. long and broad; petals 8, papilliform, about 0.25 mm. long, inserted immediately above the alternisepalous stamens; antisepalous stamens inserted immediately above the orifice, exserted, the alternisepalous inserted below the orifice, included, the anthers oblong, 0.5–0.75 mm. long and broad, sessile; disc annular, free, irregularly lobed, glabrous; pistillode lageniform, 0.75–1.25 mm. long, glabrous. Pistillate flowers: 8–15 per inflorescence; pedicel about 0.5 mm. long; calyx tube campanulate to almost urceolate, 2–3 mm. long, 1.5–2.0 mm. broad at the orifice, sericeous without, glabrous within; calyx lobes essentially as in the staminate flowers; petals 8, papilliform, about 0.25 mm. long; staminodia 8, papilliform; disc annular, basally adnate, irregularly lobed, glabrous; pistil 3.0–3.5 mm. long, the ovary ovoid, 1.5–2.5 mm. long, glabrous, the style about 0.5 mm. long, rather thick, the stigma capitate, shortly exserted. Drupe ovoid, to 13 mm. long, 7 mm. in diameter, glabrous.

This species has been collected from 1900 to 3250 meters and apparently flowers from January to October.

COLOMBIA: CUNDINAMARCA: Bogotá, *Goudot s. n.* [P (♂ ♀)], *Cuatrecasas 5251* [(♀) F, US], *7983* [(♂) F, US], *Triana 1066* [(♀) MICH, P, NY, US], *Schneider 104* [S (♀)], *200* [S (♀)], *Schultes 7016* [F (♂ ♀)], *Schultze 123* [US (♀)]; between Bogotá and Zipaquira, *Hartweg 1366* [(♀) NY (fragment), P, W]. SANTANDER: vicinity of Vetas, *Killip & Smith 17886* [(♀) A, F, NY, S, US]. WITHOUT PRECISE LOCALITY: *Bro. Ariste-Joseph s. n.* [US (♀)], *Karsten 211* [NY (♀ fragment)].

VENEZUELA: COJEDES: El Juncal, *Pittier 13718* [(♀) F, US]. FEDERAL: mountains near Galipán, *Pittier 79* [US (♀)]. MÉRIDA: Tovar, *Fendler 396* [(♂) A, K, M, NY]. TÁCHIRA: between Villapaez along Río Táchira, near Colombian-Venezuelan boundary, *Steyermark 57164* [(♂) F, NY]. WITHOUT PRECISE LOCALITY: El Avila, *Williams 11045* [(♀) F, US], *Delgado 189* [US (♂)].

Known in Venezuela as *palo rejo* and *menurito* according to Steyermark and *sabanero* according to Pittier.

Staminate specimens at anthesis are scarce in the material examined. Flowers with one or more aborted anthers are often found.

4. DAPHNOPSIS MACROPHYLLA (HBK.) Gilg, in Engl. & Prantl Pflanzenf. 3[6a]: 236. 1894.

Daphne macrophylla HBK. Nov. Gen. 2:151. 1817. [T.: *Humboldt & Bonpland 3209* (♀)!]
Daphnopsis humboldtii Meissn. in DC. Prod. 14:520. 1857, (based on *Daphne macrophylla* HBK.)
Daphnopsis humboldtii β *? boissieriana* Meissn. loc. cit. 521. 1857. [T.: *Pavon s. n.* (♂)]
Daphne laurifolia Willd. ex Meissn. loc. cit. 520. 1857, as syn.
Daphnopsis loranthifolia Standl. in Trop. Woods 42:30. 1935. [T.: *Rimbach 230* (♂)!]

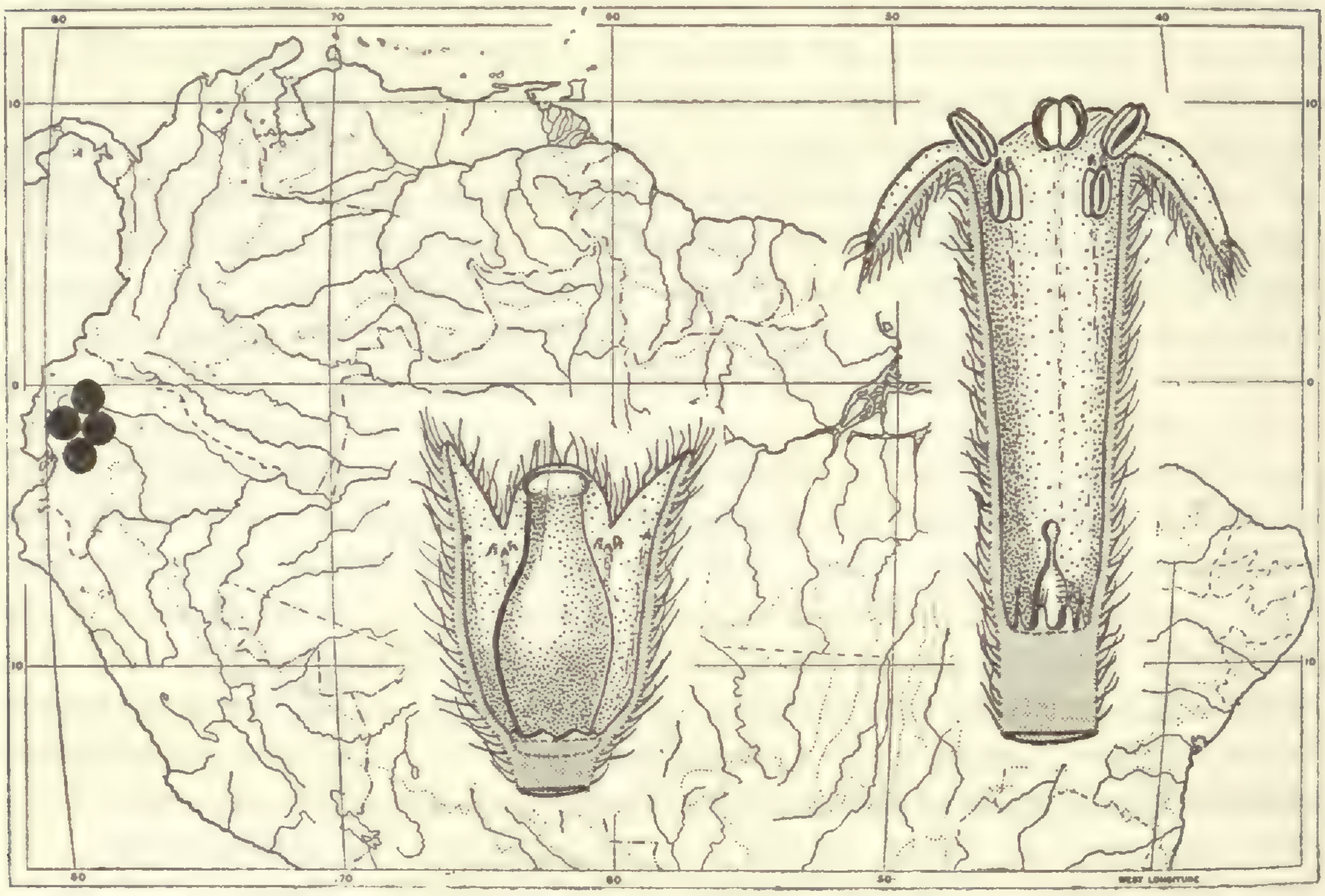

Fig. 9. *Daphnopsis macrophylla*

Shrubs to medium-sized trees, the young branches ochraceous-tomentose or sparsely to densely sericeous and glabrescent. Leaf blades elliptic to obovate, 6–15 cm. long, 2–6 cm. broad, acute to obtuse at the apex, acute at the base, subcoriaceous, tomentose or sericeous and glabrescent above and below, the costa immersed above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 3–7 mm. long. Inflorescences borne from the young leafy stems, umbelliform, sparsely tomentose to densely sericeous. Staminate inflorescence with the primary peduncle 2–5 cm. long, the rhachis 2–5 mm. long, the secondary peduncles 1–3 mm. long, dilated distally. Staminate flowers: 35–55 per inflorescence; pedicel about 1 mm. long; calyx tube narrowly obconic, sometimes inflated towards the base, 4.5–5.5 mm. long, 1.5–2.0 mm. broad at the orifice, sericeous without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer 1.5–2.5 mm. long, 1.5–2.0 mm. broad, the inner 1.5–2.0 mm. long, 1.5–2.5 mm. broad; petals 8, papilliform, about 0.25 mm. long, inserted immediately above the alternisepalous stamens; antisepalous stamens inserted immediately above the orifice, exserted, the alternisepalous inserted slightly more than an anther's length below the orifice, included, the anthers oblong, 0.5–1.0 mm. long, 0.5–0.75 mm. broad, sessile; disc annular, free, deeply and irregularly lobed, glabrous or with 1 to several hairs at the apex; pistillode tenpin-shaped, 0.5–1.5 mm. long, glabrous. Pistillate inflorescence with the primary peduncle

3–15 mm. long, the rhachis about 2 mm. long, the secondary peduncles 2–5 mm. long. Pistillate flowers: 10–20 per inflorescence; pedicel about 1 mm. long; calyx tube more or less campanulate, 2–3 mm. long, about 2 mm. broad at the orifice, tomentose to tomentellose without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer 1–2 mm. long, 0.75–1.0 mm. broad, the inner 1.5 mm. long, 1 mm. broad; petals 8, papilliform; staminodia 8, papilliform; disc annular, basally adnate, undulate, glabrous; pistil 3–4 mm. long, the ovary ovoid, glabrous, the style 0.75–1.0 mm. long, thickening with age, the stigma capitate, exserted. Drupe turbinate to ovoid, 6–15 mm. long, 6–8 mm. in diameter, glabrous.

Found at altitudes of 2400 to 2600 meters where it flowers from July to November.

ECUADOR: BOLIVAR: Chillanes, *Solís 6641* [F (♂)]. CHIMBORAZO: Bosquecito de "El Carmen", parroquia Sibambe, *Solís 5531* [F (♂)]; Huigra, *Little 6765* [US (♀)]; Allantanga, *Spruce 5567* [(♂) K, NY, P, W]. PICHINCHA: Quito, *Humboldt & Bonpland 3209* [(♀) F, P]. TUNGURAHUA: Baños, in fruticetis secus fl. Pastasa, *Spruce 5184* [A (♀), C (♂), K (♂), NY (♂), P (♂),S (♂), W (♂)]; ad pag. Baños, *Holmgren 351* [(♂) F, S, US]; north slope of Mt. Tungurahua, *Rimbach 621* [(♂) F, MICH, NY, US]. WITHOUT PRECISE LOCALITY: W. Cordillera, *Rimbach 230* [(♂) A, F, S, US], *Remy s. n.* [P (♀)].

Known in Ecuador as *sapan de perro* and *sapan serrano.* According to Solís the fruit are employed as a vigorous purgative.

The species is quite variable, particularly in pubescence. *D. loranthifolia* Standl. appears to be a specimen representative of the most pubescent extreme. Past attempts to separate the specimens into distinct entities seem to be unfounded.

The probability that *D. purdiei, D. caracasana* and *D. macrophylla* are descendents of a common ancestor seems likely. The vegetative characteristics of these species are not especially diverse and could possibly be environmentally induced. The important differences which serve to separate the species are found in the floral morphology; calyx tube shape, size and particularly disc structure. *Daphnopsis purdiei,* which is imperfectly known, appears to be primitive as deduced from the small, lobate, free, glabrous disc. *Daphnopsis caracasana* appears to be slightly advanced in that the disc lobes of the staminate flowers are more or less connate. The pistillate flowers have a disc which is slightly adnate at the base and which unfortunately cannot be compared with the equivalent structure in *D. purdiei. Daphnopsis macrophylla* appears more advanced in that the disc of the pistillate flower is not only slightly more adnate at the base but also is connate. The disc in the staminate flowers does not show similar development.

Although there appears to be a disjunction in the range of these three species it must be emphasized that they are all inhabitants of the Andean cordillera and that they presumably arrived at their present positions after being continuous at one time. This group of species is best thought of as a former "Rassenkreis" in which the populations have become isolated and floral differences have become great enough so that they cannot be treated as subspecies of the same species.

5. Daphnopsis purpusii Brandg. in Univ. of Calif. Publ. Bot. 4:89. 1910. [T.: *Purpus 4116* (♂)!]

Daphnopsis purpusii var. *ehrenbergii* Domke, in Notizbl. 12:728. 1935. [T.: *Ehrenberg 1012* (♀)]
Daphnopsis decidua Domke, loc. cit. 726. 1935. [T.: *Purpus 4447'* (♂)]

Shrubs, the young branches woolly or glabrous. Leaf blades elliptic to obovate, 1–5 cm. long, 0.5–1.5 cm. broad, acute to rotund at the apex, cuneate at the base, subcoriaceous, glabrous or woolly and glabrescent above and below, the costa plane above, emersed below, the primary lateral veins prominulous on both surfaces, arcuate-ascending; petiole 1–3 mm. long. Inflorescences borne from the young leafy stems, umbelliform, tomentose, the primary peduncle 2–11 mm. long, the rhachis about 1 mm. long, the secondary peduncles less than 1 mm. long. Staminate flowers: 4–8 per inflorescence; pedicel 0.5–1.5 mm. long; calyx tube narrowly to broadly obconic, about 6.5 mm. long, 1–2 mm. broad at the orifice, densely sericeous to puberulent without, glabrous within; calyx lobes subequal, puberulent within, about 2.5 mm. long, 1.0–1.5 mm. broad; petals 8, papilliform to squamelliform, about 0.25 mm. long, inserted immediately below the orifice; antisepalous stamens inserted slightly above the orifice, exserted, the alternisepalous inserted slightly more than an anther's length below the orifice, included, the anthers oblong, about 0.75 mm. long, 0.5 mm. broad, sessile or subsessile; disc annular, basally adnate, short-lobate, glabrous; pistillode tenpin-shaped, 1.0–1.75 mm. long, glabrous. Pistillate flowers not seen. Fruit ovoid, 7–9 mm. long, 4–7 mm. in diameter, glabrous.

Fig. 10. *Daphnopsis purpusii*

MEXICO: PUEBLA: Acatzinio, *Bro. Nicolas 6105* [US (♂ ♀)]; Cerro de Paxtle, *Purpus 4116* [(♂ ♀) A, F, MO, NY, US]; Tehuacan, *Purpus 4447* [(♂) A, F, MO, US], *5707* [A (♀), BM (♀), F (♀), MO (♀), NY (♀), P (♂), US (♀)].

The plants of this species are readily separable into two groups on the basis of leaf pubescence: those which are woolly (typical *D. purpusii*) and those which are glabrous or essentially so (*D. purpusii* var. *ehrenbergii*). *Daphnopsis decidua* Domke is based on specimens which were collected very early in the growing season and upon maturity would be grouped with the glabrous specimens. The floral morphology is identical in all specimens examined and for this reason they are placed in a single species. The extreme pubescence differences could be due to the action of a single gene.

6. DAPHNOPSIS MOLLIS (Cham. & Schlechtd.) Standl. in Contrib. U. S. Nat. Herb. 23:1013. 1924, where parenthetically ascribed to Meissn.

Daphne bonplandiana HBK. var. *mollis* Cham. & Schlechtd. in Linnaea 6:364. 1831. [T.: *Schiede 1138* (♀)!]
Daphnopsis bonplandii β mollis (Cham. & Schlechtd.) Meissn. in DC. Prod. 14:521. 1857.

Shrubs or trees, 1–15 m. tall, the young branches ochraceous-tomentose. Leaf blades obovate to oblanceolate, 4–13 cm. long, 2.5–4.0 cm. broad, subcaudate-acuminate to acute or obtuse at the apex, attenuate at the base, subcoriaceous, glabrous above, densely hirsute to sparsely hirsute below, the costa immersed above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 4–7 mm. long. Inflorescences borne from the young leafy stems, umbelliform, hirsute. Staminate inflorescence with the primary peduncle 1.0–2.5 cm. long, the rhachis about 2 mm. long, the secondary peduncles 1–2 mm. long. Staminate flowers: 7–11 per inflorescence; pedicel 1.5–3.0 mm. long; calyx tube broadly campanulate, 2.5–3.0 mm. long, 2–3 mm. broad at the orifice; calyx lobes unequal, puberulent within, the outer 3.0–4.5 mm. long, 1.0–1.5 mm. broad, the inner about 2.75 mm. long, 2.5 mm. broad; petals 8, papilliform, about 0.25 mm. long, inserted immediately above the alternisepalous stamens; antisepalous stamens inserted about an anther's length above the orifice, exserted, the alternisepalous inserted about an anther's length below the orifice, exserted, the filaments unequal, antisepalous about 2.5 mm. long, alternisepalous 1.5–2.0 mm. long, the anthers oblong, 0.75–1.0 mm. long, 0.5 mm. broad; disc annular, completely adnate, undulate, glabrous; pistillode lageniform, about 1 mm. long, setose. Pistillate inflorescence with the primary peduncle 0.5–1.0 cm. long, the rhachis about 1 mm. long, the secondary peduncles 1–2 mm. long. Pistillate flowers: 3–8 per inflorescence; pedicel 2–3 mm. long; calyx tube campanulate, 2.0–2.5 mm. long, 1.5–2.5 mm. broad at the orifice, hirsute without, glabrous within; calyx lobes subequal, puberulent within, 1.0–1.5 mm. long and broad; petals 8, papilliform, extremely small; staminodia 8, papilliform; disc as in staminate flower; pistil about 3.75 mm. long, the ovary fusiform, setose toward the apex, the style about 1.5 mm. long, the stigma minutely capitate, greatly exserted. Drupe ovoid, 10–12 mm. long, 7–8 mm. in diameter, glabrous, the style sometimes persistent.

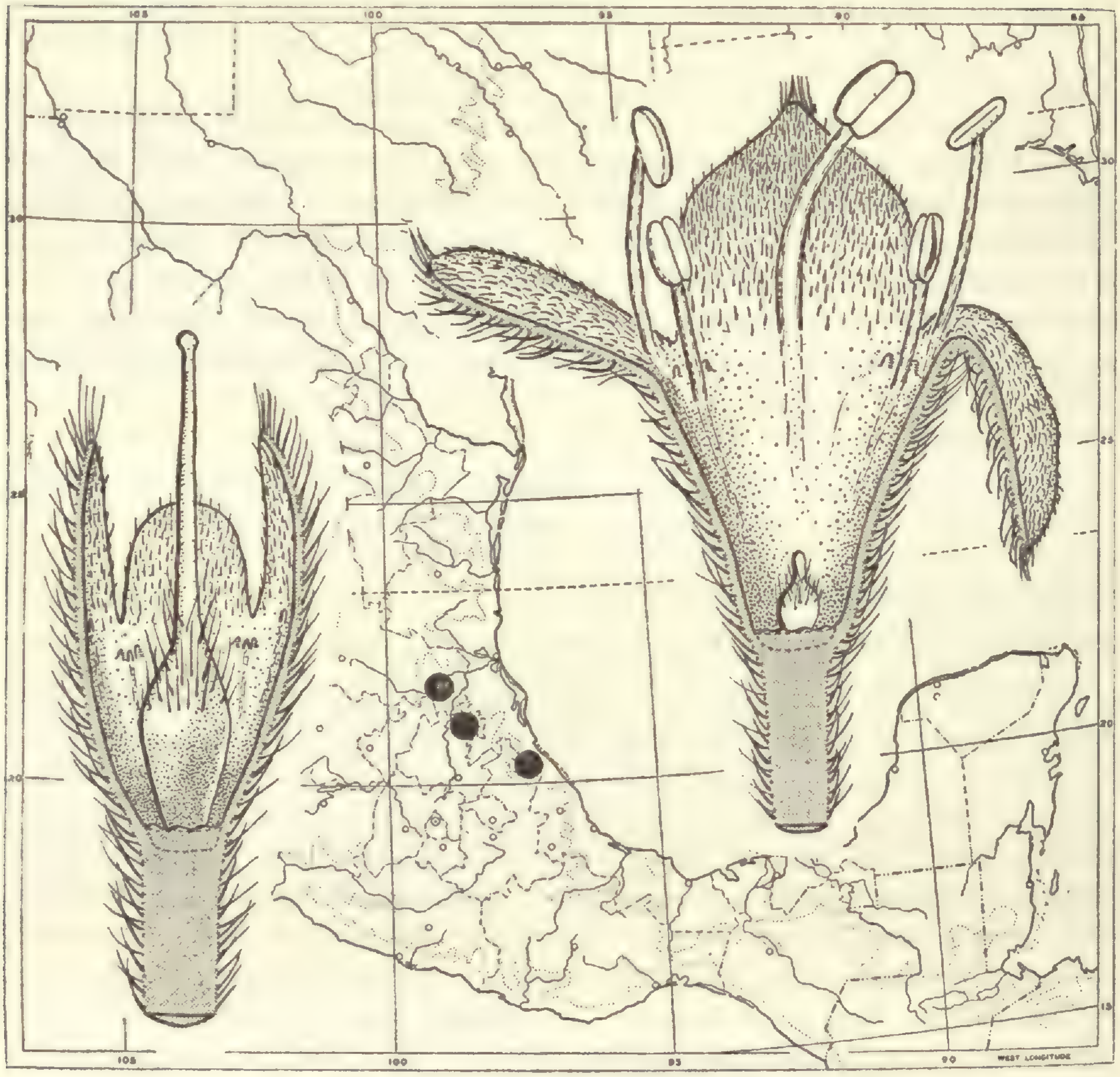

Fig. 11. *Daphnopsis mollis*

All specimens of this species examined were collected at altitudes from 300 to 1000 meters. Flowering specimens are known only from July and August although the flowering period is probably longer.

MEXICO: HIDALGO: above Chapulhacan, *Kenoyer A617* [F (♀)], *Lundell & Lundell 7183* [(♂) GH, MICH], *Lundell 12235* [MICH (♀)]; Puerto de Zopilote, *Lundell & Lundell 12409* [MICH (♂)]. SAN LUIS POTOSI: Tamasopo Canyon, near Las Canoas, *Pringle 3563* [(♂♀) A, MICH, US]. VERACRUZ: Papantla, *Scheide 209* [W (♀)], *1138* [(♀) MO, W].

Meissner correctly made the transfer of the *mollis* variety to the genus *Daphnopsis*, but, as was his custom, he did not ascribe it to the original author. Standley was apparently unaware of this custom and thus ascribed the epithet *mollis* to Meissner. Meissner was fully aware of Chamisso and Schlechtendahl's priority as evidenced by his citation of their publication.

7. DAPHNOPSIS **perplexa** Nevl. **spec. nov.**

Frutices vel arbores; ramis juvenibus tomentosis. Folia elliptica usque oblanceolata 5–12 cm. longa 1–4 cm. lata apice acuminata basi cuneata subcoriacea tomentosa usque glabrescentia venis primariis lateralibus arco-ascendentibus; petiolo 3–13 mm. longo. Inflorescentia umbelliformis tomentosa dense usque sparse; pedunculo primario 0.5–1.5 mm. longo; rhachide ca. 1 mm. longo; pedunculis secundariis ca. 1 mm. longis. Flores masculi non vidi. Flores feminei: 8–15 per inflorescentia; pedicello 2–5 mm. longo; calyce campanulato 1.25–2.5 mm. longo 1.0–1.5 mm. lato extus tomentoso intus glabro; calycis lobis subequalibus intus puberulis ca. 0.75 mm. longis 0.5 mm. latis; petalis 8 papilliformibus ca. 0.25 mm. longis; staminodiis 8 papilliformibus; disco humili adnato glabro; pistillo 2.0–2.5 mm. longo ovario ovato glabro stigmate capitato exserto. Fructus ovatus ca. 11 mm. longus 3–4 latus glaber. HOLOTYPUS: *Purpus 10191* (GH).

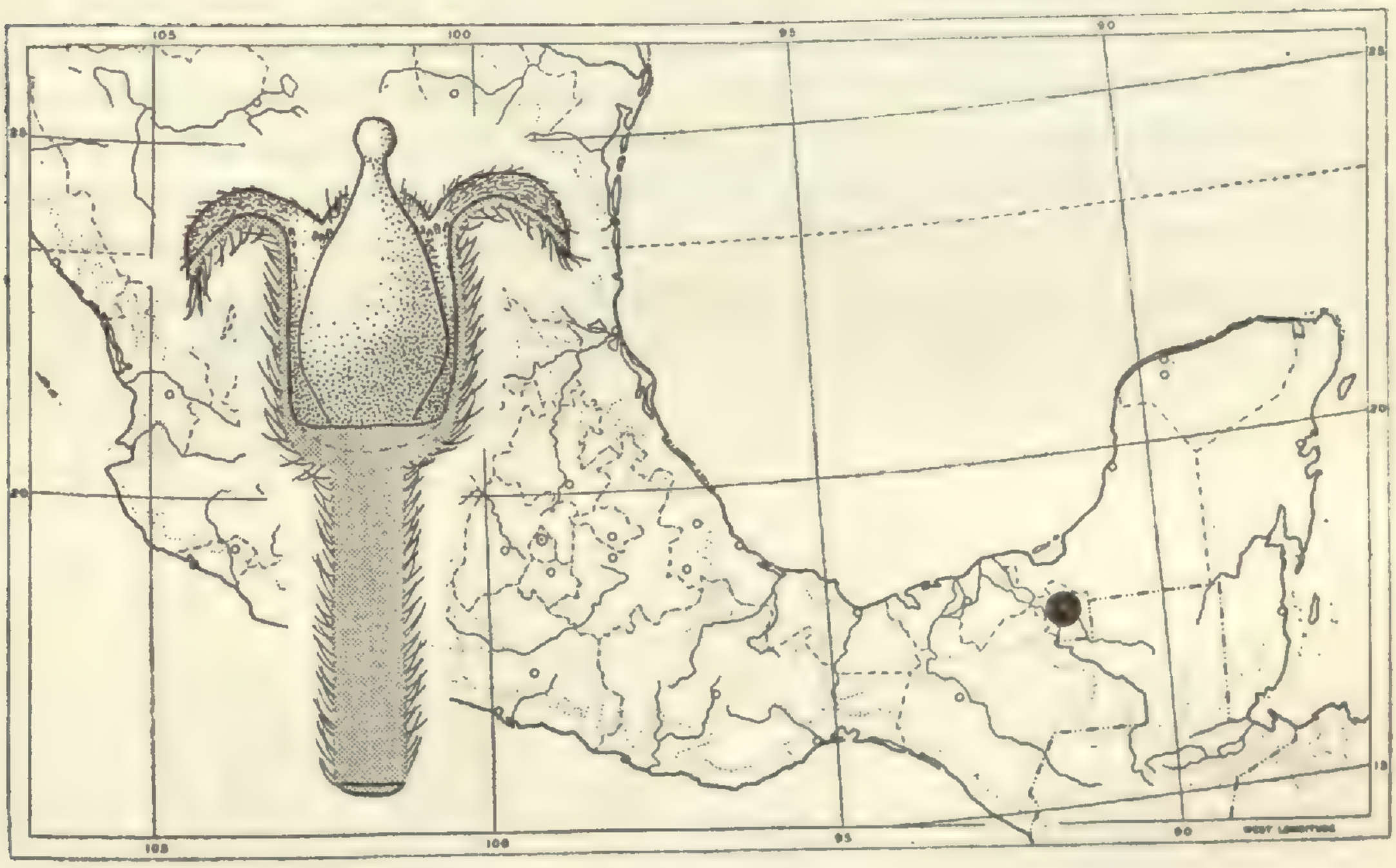

Fig. 12. *Daphnopsis perplexa*

MEXICO: TABASCO: Monserrate, *Purpus 10048* [(♀) NY, US], *10190* [(♀) M, S, US], *10191* [(♀) GH, US].

Although the species appears superficially similar to *D. americana* it is distinguished from it primarily by the presence of petals as well as by several other characters of secondary importance. The pistillate flower illustrated is probably a young fruit, neither immature pistillate flowers nor staminate flowers have been seen.

8. DAPHNOPSIS MONOCEPHALA Donn. Sm. in Bot. Gaz. 47:261. 1909. [T.: *Kellerman 5714* (♂)!]

Daphnopsis retifera Standl. & Steyerm. in Field Mus. Publ. Bot. 22:254. 1940. [T.: *Steyermark 31758* (s)!]

Shrubs to 3 m. tall, the young branches ochraceous-woolly and glabrescent. Leaf blades obovate to oblanceolate, 3–18 cm. long, 1–6 cm. broad, acute to obtuse at the apex, narrowly cuneate at the base, coriaceous, sparsely sericeous and soon glabrescent and olive-green becoming reddish-brown above on drying, strigose and gray-green below, the costa immersed above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 1–8 mm. long. Inflorescences borne from the young leafy stems, umbelliform, tomentose, the primary peduncle 0.7–3.5 mm. long, the rhachis about 1 mm. long, the secondary peduncles less than 1 mm. long. Staminate flowers: 30–40 per inflorescence; pedicel about 0.5 mm. long; calyx tube narrowly obconic, 3.0–3.5 mm. long, 1.5 mm. broad at the orifice, sericeous without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer about 1.5 mm. long, 1 mm. broad, the inner about 1.5 mm. long and broad; petals 4, digitiform, inserted at the orifice; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted two anthers' lengths below the orifice, included, the anthers oblong, 0.5–0.75 mm. long, 0.25–0.5 mm. broad, sessile; disc short-lobate, free, glabrous; pistillode tenpin-shaped, 0.75 mm. long, glabrous. Pistillate flowers and fruit not seen.

This species is found on dry rocky hillsides from 600 to 1100 meters and is known to flower in January.

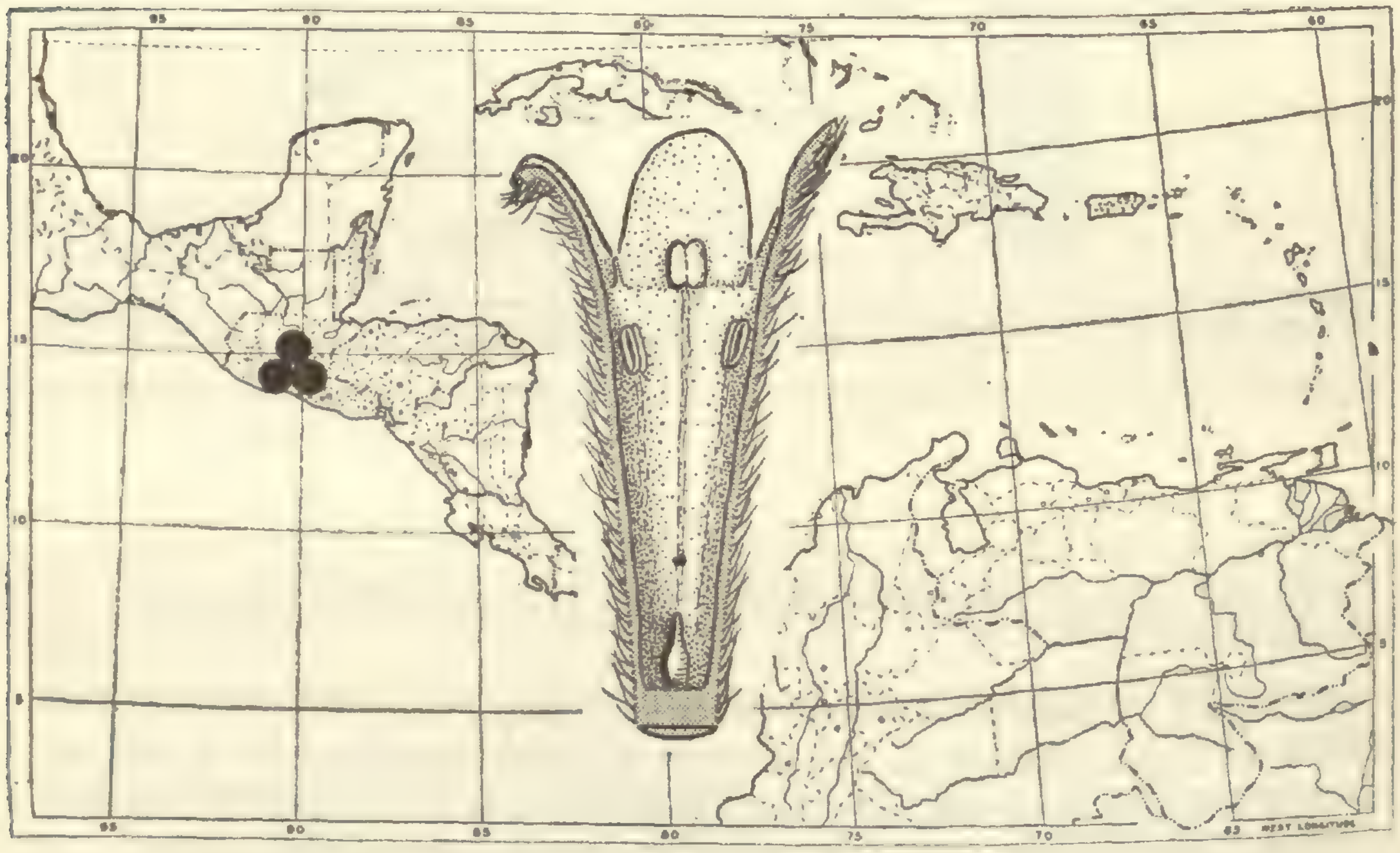

Fig. 13. *Daphnopsis monocephala*

GUATEMALA: BAJA VERAPAZ: opp. El Rancho, *Kellerman 5714* [US (♂)]. CHIQUIMULA: divide on the railway above El Rincón, *Standley 74746* [F (s)], *80409* [F (s)]. GUATEMALA: near Fiscal, *Standley 80372* [(s) F, US]. JUTIAPA: between railroad station of Mita and town of Asunción Mita, *Steyermark 31758* [F (s)].

This species is reminiscent of *D. helleriana* of Puerto Rico and may be related to it. Unfortunately, pistillate flowers have not been observed in either species.

9. DAPHNOPSIS HELLERIANA Urb. Symb. Ant. 2:453. 1901. [T.: *Heller 4689* (♂)!]

Shrubs or trees (?), the young branches golden-tomentose and glabrescent. Leaf blades elliptic, oblong or obovate, 3–15 cm. long, 2.0–5.5 cm. broad, mucronulate to obtuse at the apex, cuneate at the base, coriaceous, glabrous and reddish-brown above, golden tomentose soon glabrescent and light green with reddish-brown pigment bordering the veinlets below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 2–6 mm. long. Inflorescences borne on the young leafy stems, umbelliform,

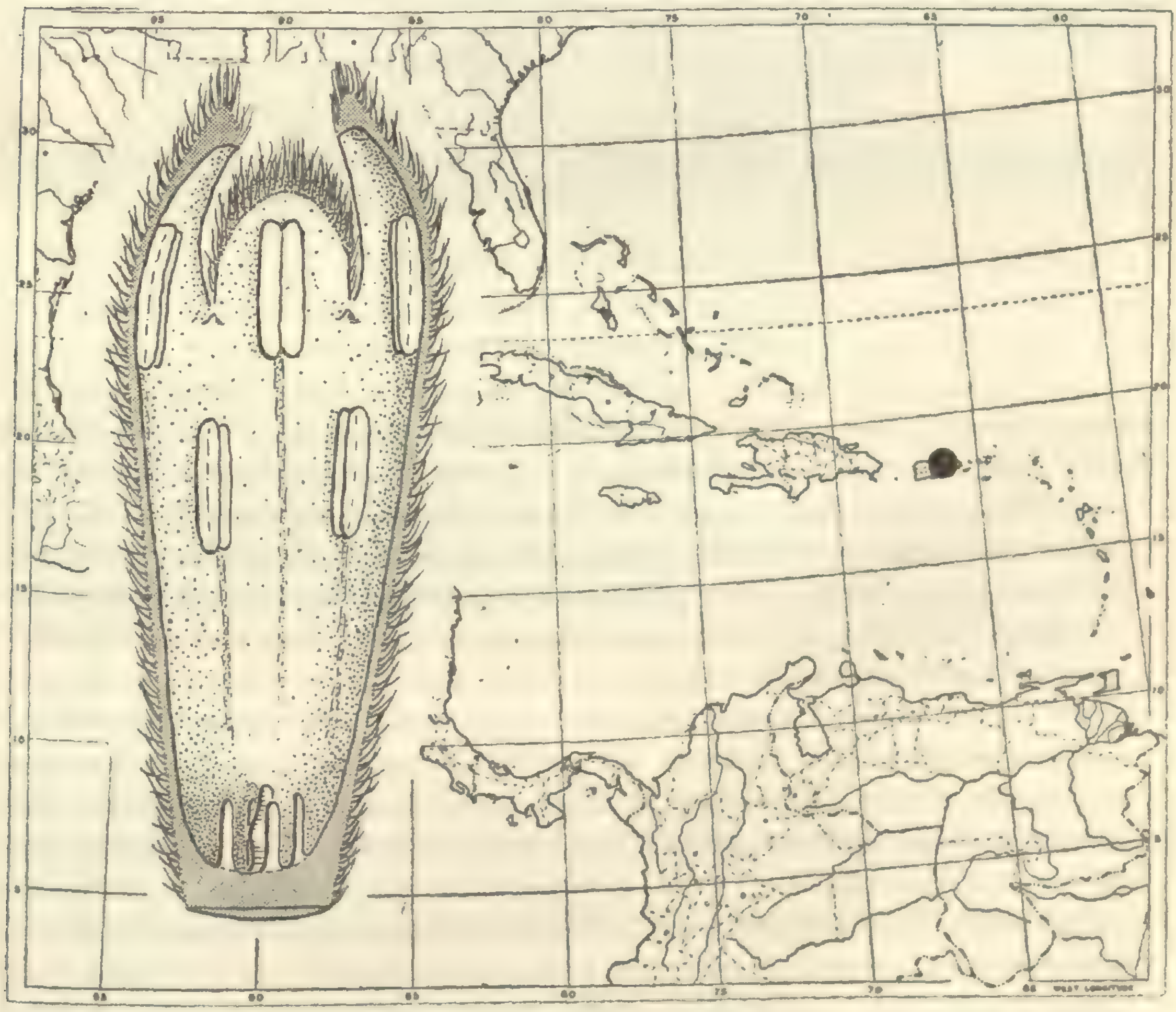

Fig. 14. *Daphnopsis helleriana*

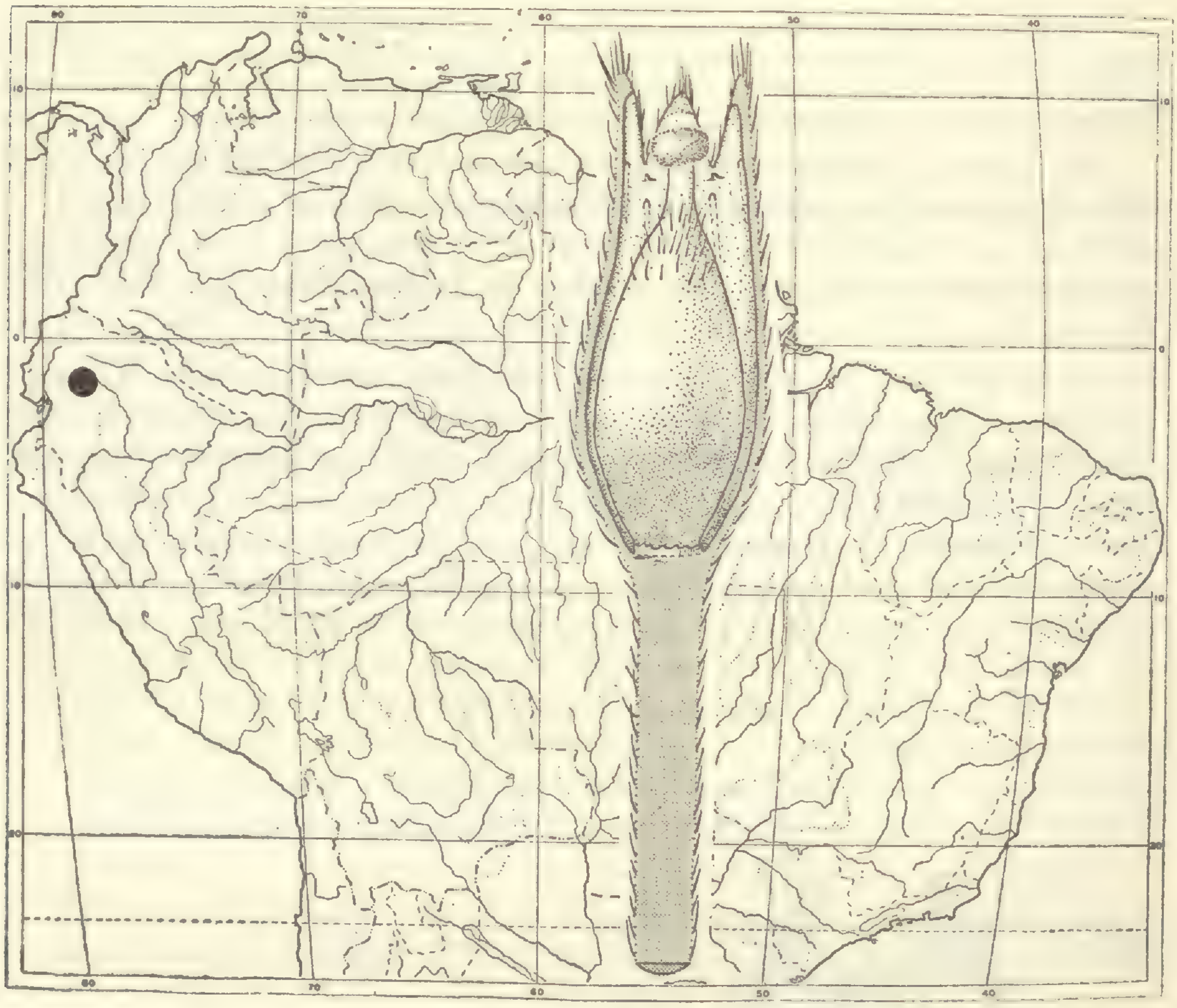

Fig. 15. *Daphnopsis equatorialis*

golden-tomentose, the primary peduncle 5–10 mm. long, nodding, the rhachis about 1 mm. long, the secondary peduncles 1–3 mm. long. Staminate flowers: 3–5 per inflorescence; pedicel 0.5–1.0 mm. long; calyx tube obconic (?), 5–6 mm. long, 2–3 mm. broad at the orifice, golden-tomentose without, glabrous and somewhat red-pigmented within; calyx lobes unequal, indefinitely papillate within, the outer about 2 mm. long, 2.5 mm. broad, the inner 1.5 mm. long and broad; petals 4, squamelliform, as long as broad, inserted at the orifice; antisepalous stamens inserted at the orifice, exserted, the alternisepalous inserted about two anthers' lengths below the orifice, included, the anthers oblong, 1.5 mm. long, 0.5 mm. broad, sessile; disc of a few irregular lobes almost as tall as the pistillode, free, glabrous; pistillode fusiform, about 1 mm. long, glabrous. Pistillate flowers and fruit not seen.

Apparently flowers in February although the specimens examined had not attained anthesis. Found on calcareous hills at an altitude of about 75 feet.

PUERTO RICO: SAN JUAN: near Bayamon, *Heller 4689* [(♂) A, F, GH, MICH, NY, US].

This very poorly known species is reminiscent of the preceding species, *D. monocephala*, but very distinct from it. It is also similar in vegetative characters to *D. ekmanii* which is treated with the species of undetermined status.

10. Daphnopsis **equatorialis** Nevl. spec. nov.

Frutices; ramis juvenibus pubescentibus usque glabrescentibus. Folia elliptica usque oblongo-elliptica 22–28 cm. longa 6.0–7.5 cm. lata apice acuta basi cuneata coriacea glabra, venis primariis lateralibus arco-ascendentibus; petiolo 6–10 mm. longo. Inflorescentia feminea umbelliformis; pedunculo primario 6–8 mm. longo; rhachide 3–5 mm. longo; pedunculis secundariis ca. 0.25 mm. longis. Flores feminei 30–40 per inflorescentia; pedicello ca. 4 mm. longo; calyce urceolato ca. 4.5 mm. longo 1.5 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus glabris ca. 1 mm. longis 0.75 mm. latis; petalis 4, papilliformibus; staminodiis 8, papilliformibus; disco humili lobato libero glabro; pistillo 4.0–4.5 mm. longo ovario ovato superne piloso stigmate capitato subexserto. Fructus ca. 2 mm. longus 1 mm. latus. Flores masculi non vidi. HOLOTYPUS: *Lugo 198* (S).

Ecuador: napo-pastaza: Mera, *Lugo 198* [S (♀)].

This new species is very distinct from the other species of *Daphnopsis* having four petals. I was not prepared to find a four-petaled species in this area although I now suspect that increased collecting will turn up more novelties.

11. Daphnopsis oblongifolia Britt. & Wils. in Mem. Torrey Bot. Club 16:85. 1920. [T.: *Britton & Cowell 13301* (♂)!]

Shrubs to 2 m. tall, the young branches appressed-puberulent and glabrescent. Leaf blades linear-oblong to oblong or elliptic-oblong, 2–7 cm. long, 3–5 mm. broad, acute to mucronulate at the apex, narrowly cuneate at the base, coriaceous, somewhat thickened and revolute at the margin, glabrous above and below, the costa not visible above, prominulous below, the primary lateral veins not visible above, prominulous below, more or less parallel with the costa; petiole 2–3 mm. long. Inflorescences borne terminally or from axillary brachyblasts on the younger leafy stems, umbelliform, puberulent, the primary peduncle 1–7 mm. long, nodding, the rhachis less than 0.5 mm. long, the secondary peduncles less than 1 mm. long. Staminate flowers: 2–4 (–6) per inflorescence; pedicel about 3 mm. long; calyx tube obconic, 2.5–3.5 mm. long, 1.0–1.5 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, sparsely puberulent within, 1.0–1.5 mm. long and broad; petals 4, papilliform, less than 0.25 mm. long, inserted at the orifice; antisepalous stamens inserted immediately above the orifice, exserted, the alternisepalous inserted less than two anthers' lengths below the orifice, included, the anthers oblong, about 0.5 mm. long, 0.25–0.5 mm. broad, sessile; disc of free lobes, glabrous; pistillode lageniform, 0.5–0.75 mm. long, minutely setose. Pistillate flowers: 2–3 per inflorescence; pedicel about 2.5 mm. long; calyx tube campanulate, about 1.5 mm. long, 1 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes unequal, sparsely puberulent within, the outer 0.25

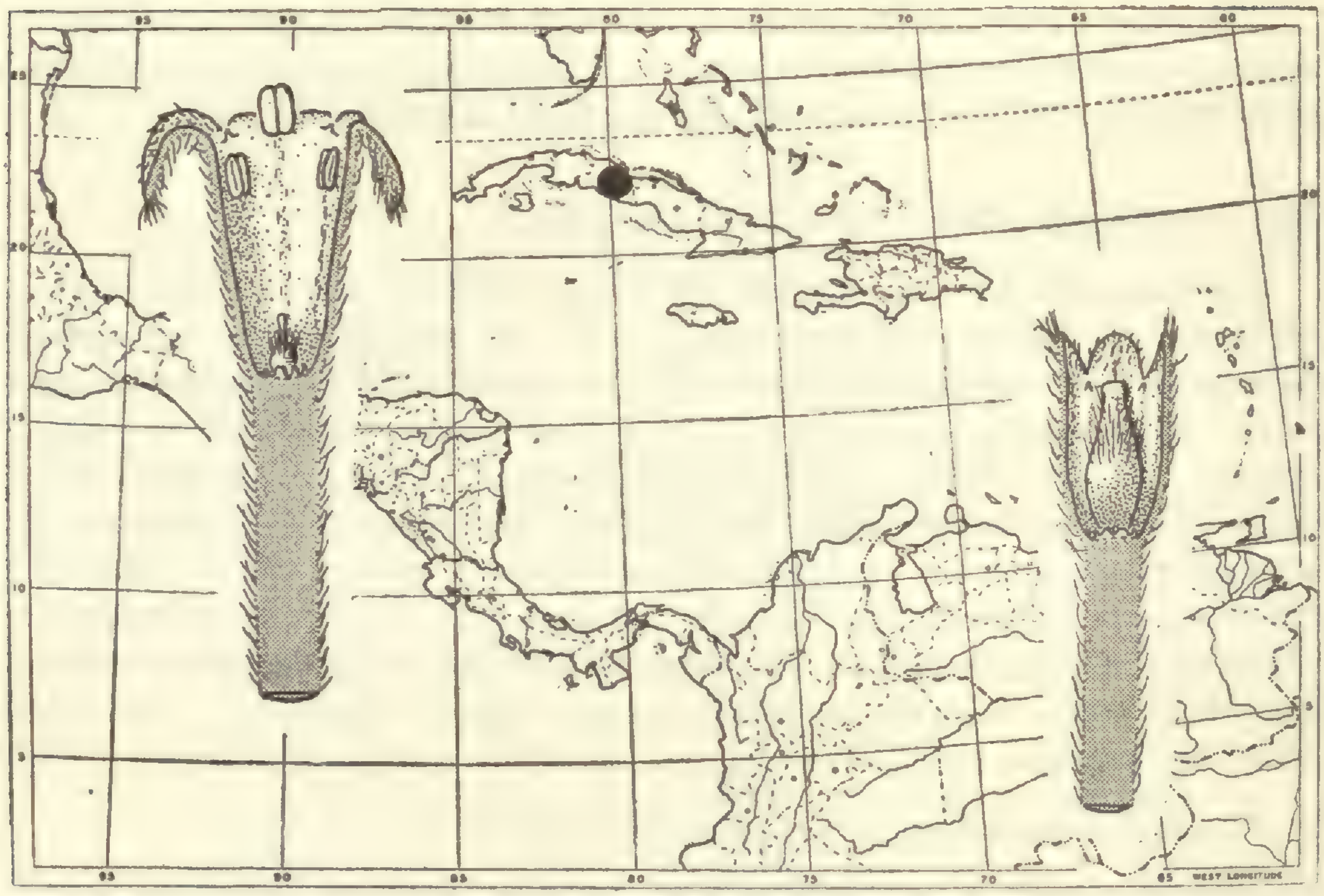

Fig. 16. *Daphnopsis oblongifolia*

mm. long, 0.5 mm. broad, the inner 0.5 mm. long and broad; petals as in staminate flowers; staminodia 8, obscure; disc annular, free, irregularly lobed, glabrous; pistil about 1.5 mm. long, the ovary ovoid, setose at the apex, the style thickened, the stigma capitate, included. Fruit not seen.

Flowers from March to late June in serpentine areas.

CUBA: CAMAGÜEY: sab. de la Matanzas, *Roig 810* [NY (?)]. SANTA CLARA: serpentine area 10 kms. south of Santa Clara, *Howard, Briggs, Kamb, Lane & Ritland 292* [IAN (?), MO (?), NY (♂), US (?)]; near Santa Clara, *Bro. León 15625* [(?) MO, NY], *Britton & Cowell 13301* [(♂) A, F, MO], *Ekman 12035* [S (♂)], *14035* [NY (♀)], *18833* [S (♂)]; Santa Clara towards Manicaragua, *Britton & Cowell 10256* [(?) F, NY, US].

Specimens of this species are quite similar to *D. hispaniolica* and *D. calcicola* due to the similarity of vegetative parts. It may be closely related to the following species, *D. calcicola*, but differs from it primarily in the small petals.

12. DAPHNOPSIS CALCICOLA Ekm. ex Urb. Symb. Ant. 9:407. 1925. [T.: *Ekman 16669* (♀)!]

Shrubs or small trees, the young branches subsericeous and glabrescent. Leaf blades obovate-oblong, 2–4 cm. long, 0.5–1.3 cm. broad, more or less obtuse at the apex, cuneate-attenuate at the base, coriaceous, strigose and glabrescent above and below, the costa and primary lateral veins prominent above and below, the primary lateral veins almost parallel with the costa; petiole 2–3 mm. long. Inflorescences borne from the young leafy stems, umbelliform, sericeous, the primary

Fig. 17. *Daphnopsis calcicola*

peduncle 2–6 mm. long, the rhachis about 1 mm. long, the secondary peduncles about 1 mm. long. Staminate flowers not seen. Pistillate flowers: 3–6 per inflorescence; pedicel 2–3 mm. long; calyx tube campanulate, about 1.5 mm. long, 1.0–1.5 mm. broad at the orifice, tomentose without, glabrous within; calyx lobes subequal, tomentose within, 0.75 mm. long, 0.5 mm. broad; petals 4, obovate, tomentose, about 0.75 mm. long, 0.5 mm. broad; staminodia absent; disc annular, basally adnate, short-lobed, glabrous; pistil 2.0–2.5 mm. long, the ovary ovoid, minutely setose towards the apex, the style somewhat thickened, the stigma capitate, exserted. Drupe ellipsoid, 9–10 mm. long, 5–6 mm. in diameter, minutely setose.

Found on limestone at about 500 meters altitude, flowers from June to November.

CUBA: PINAR DEL RÍO: Viñales in Ensenada de Vega Cuchilla in Sierra del Sitio Santo Tomás, *Ekman 16669* [(♀) NY, S], *18010* [(♀) NY, S].

The similarity of the leaves of *D. hispaniolica*, *D. oblongifolia* and *D. calcicola* has been mentioned previously but it may be worthwhile to point out that the similarity is not as strong as the dissimilarity between the leaves of these species and those which comprise the remainder of the genus. These three species are inhabitants of either limestone or serpentine areas and the peculiar leaf shape may be involved with some adaptation for life in these soils.

The petals of *D. calcicola* are the largest of any in the genus and appear to be excellent material for the study of petal anatomy, except for the paucity of material.

13. DAPHNOPSIS OCCIDENTALIS (Sw.) Krug & Urb. in Engl. Bot. Jahrb. 15:349. 1893.

Daphne occidentalis Sw. Prod. 63. 1788. [T.: *Swartz s. n.* (s)!]
Gastrilia umbellata Raf. Flor. Tellur. 4:105. 1836, (based on *Daphne occidentalis* Sw.)
Daphnopsis swartzii Meissn. in DC. Prod. 14:522. 1857, (based on *Daphne occidentalis* Sw.)

Shrubs or slender trees to 10 m. tall, the young branches puberulent and glabrescent. Leaf blades oblanceolate, obovate or elliptic, 3–15 cm. long, 1–4 cm. broad, subcaudate-acuminate, acute or obtuse at the apex, attenuate-cuneate at the base, membranaceous, sericeous and glabrescent above, sericeous to appressed-puberulent below, the costa emersed above and below, the primary lateral veins prominent above and prominulous below, arcuate-ascending; petiole about 3 mm. long. Inflorescences borne from the young leafy stems, umbelliform, puberulent. Staminate inflorescence with the primary peduncle 1–8 cm. long, the rhachis 1–3 mm. long, the secondary peduncles 0.5–2.0 mm. long. Staminate flowers: 5–12 per inflorescence; pedicel 2–5 mm. long; calyx tube obconic, 3.5–5.5 mm. long, 1.0–1.5 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer about 2.0 mm. long, 1.25–1.5 mm. broad, the inner about 1.5 mm. long, 1.0 mm. broad; petals connate into an obscure faucal annulus with 4 prominent alternisepalous lobes; antisepalous stamens inserted at the orifice, exserted, the alternisepalous inserted below the orifice, included, the

Fig. 18. *Daphnopsis occidentalis*

anthers oblong, 0.5–0.75 mm. long, 0.5 mm. broad, sessile; disc annular, free, about 0.25 mm. tall, erose, glabrous; pistillode tenpin-shaped, 1.5 mm. long, glabrous. Pistillate inflorescence with the primary peduncle 1.0–3.5 cm. long, the rhachis about 1 mm. long, the secondary peduncles 0.1–3.0 mm. long. Pistillate flowers: 5–15 per inflorescence; pedicel 1–4 mm. long; calyx tube urceolate, about 2 mm. long, 1.0–1.25 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer 1.5 mm. long, 1 mm. broad, the inner about 1 mm. long, 0.75 mm. broad; petals connate into an obscure faucal annulus with 4 prominent alternisepalous lobes; staminodia absent; disc annular, basally adnate, about 0.25 mm. tall, erose, glabrous; pistil about 2.25–2.5 mm. long, the ovary ovoid, glabrous, the style somewhat thickened, the stigma capitate, exserted. Drupe ovoid, approximately 13 mm. long, 10 mm. in diameter, glabrous, white.

Flowers from August to October at altitudes of 800 to 100 meters.

JAMAICA: CLARENDON: Peckham Woods, *Harris 11185* [F (♂), NY (♂), US (♂ ♀)]; Croft's Mountain, *Harris 11218* [(♂) F, MO, NY, US]. MANCHESTER: Battersea Woods near Christiana, *Harris 8269* [A (♀), F (♀), NY (♀), P (♂)]; ½ mile NW of Christiana, *Proctor 10585* [(♀) A, MO]. ST. ANDREW: Mona Hill, vicinity of Kingston, *Britton 381* [NY (?)]. ST. ANN: 2 mi. w. of Albion, *Howard & Proctor 14883* [A (♂)]. ST. CATHERINE: Mt. Diabolo, *Harris 8965* [(♂) A, F, NY], *8967* [(♀) F, NY, S], *9002* [(♀) F, NY]. ST. ELIZABETH: Santa Cruz Mountains, Potsdam, *Britton 1287* [NY (♂)]; near Troy, *Harris 8793* [(♂) F, NY, W], *9394* [(♂) A, F, NY US]. WITHOUT PRECISE LOCALITY: Iron Face, Chester Vale, *Harris 10023* [(♀) F, NY, US]; *Alexander s. n.* [NY (♂)], *Purdie s. n.* [S (♀)], *Swartz s. n.* [(s) C, S].

This species, which has very variable leaves, is easily distinguishable by its long, slender primary peduncles and by the presence of a faucal annulus with four prominent alternisepalous lobes.

14. DAPHNOPSIS liebmannii Nevl. spec. nov.

Frutices nisi arbores; ramis juvenibus hispidulis. Folia elliptica 3–7 cm. longa 1.0–2.5 cm. lata apice acuminata basi cuneata chartacea supra glabra subtus hirtella, venis primariis lateralibus arco-ascendentibus; petiolo 2–4 mm. longo. Inflorescentia umbelliformis strigosa; pedunculo primario 2–5 mm. longo; rhachide ca. 0.25 mm. longo; pedunculis secundariis 0.5–2.0 mm. longis. Flores masculi 4–8 per inflorescentia; pedicello obsoleto; calyce obconico 7–9 mm. longo 1.0–1.5 mm. lato extus hispidulo intus glabro; calycis lobis subequalibus intus glabris ca. 2 mm. longis 1.5 mm. latis; petalis in annulum brevissimum connatis; staminibus in planis 2, antheris oblongis 1.0–1.5 mm. longis 0.5 mm. latis sessilibus; disco humili 4-lobato libero pubescente; pistillodio ampulliformi apice quamquam dilatato ca. 1.5 mm. longo pubescente. Flores feminei 6–14 per inflorescentia; pedicello ca. 1 mm. longo; calyce urceolato 2 mm. longo 0.5–0.75 mm. lato extus hispidulo intus glabro; calycis lobis subequalibus intus glabris ca. 1 mm. longis 0.5 mm. latis; petalis in annulum brevissimum connatis; staminodiis 4 papilliformibus; disco humili lobato libero pubescente; pistillo ca. 2.5 mm. longo ovario ovato superne minute piloso stigmate capitato exserto. Fructus ovatus ca. 7 mm. longus ca. 4 mm. latus. HOLOTYPUS: *Liebmann 4293* (F).

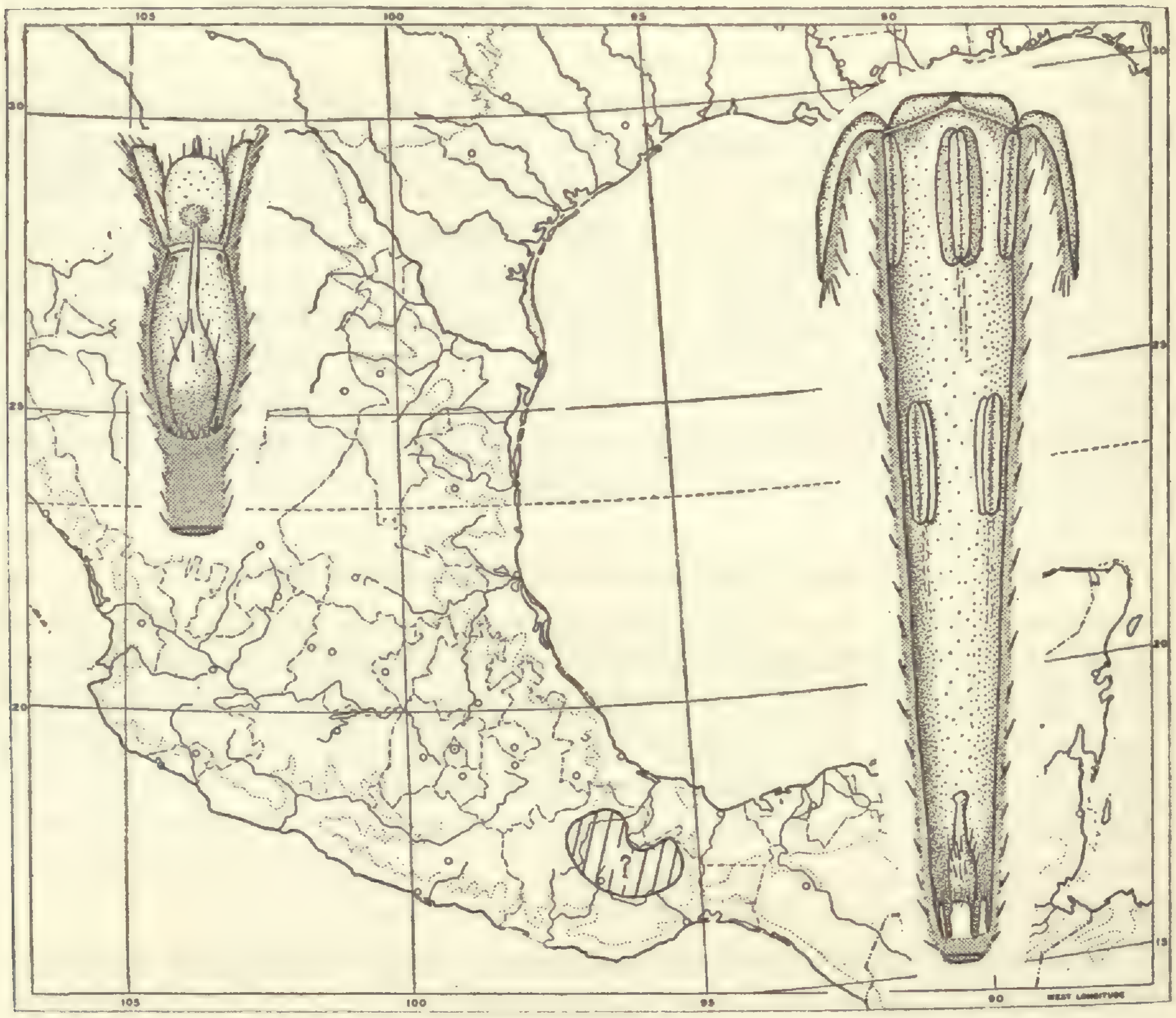

Fig. 19. *Daphnopsis liebmannii*

MEXICO: OAXACA: Laguna, *Liebmann 4293* [A(♂♀), C (♂), F (♂♀)], *14383* [A (♂), C (♂♀), F (♂), US (♀)].

This new species is known only from two Liebmann collections which are simple marked "Laguna, August 1842". I have assumed the place of collection to be in Oaxaca based on the following information contained in Chênes de l'Amerique Tropicale by A. S. Ørsted, 1869, page viii.

"Après avoir visité les ruines du palais de Mitla, Liebmann quitta Oajaca le 1er Juin, parcourut tout le Mineral oriental d'Oajaca, et fit l'ascension du célèbre monte Sempoaltepic, qui s'élève à une hauteur de 12000 pieds, et dont la végétation est toute différente de celle de l'Orizaba. Dans la contrée montagneuse peu connue et peu habitée de Chinantla, Liebmann fit une riche moisson de plantes nouvelles, parmi lesquelles beaucoup de palmiers et de Chênes. A son retour de Chinantla, il passa un mois dans une plantation de sucre, au pied du Sempoaltepec; il continua ensuite sa route par Villa Alta, la mine d'argent de Gertrudes près Talea, et Tanetze, franchit le mont El Pelado (9800 pieds), et s'arrêta à l'hacienda de Yavesia, qui était alors le siège de la 'Mexican Silvermining Company'.

"Liebmann séjourna un peu plus de deux mois dans la partie occidentale de Mexique; il quitta Oajaca au commencement d'Octobre . . . "

15. Daphnopsis **mexiae** Nevl. spec. nov.

Frutices vel arbores usque 7 m. alti; ramis juvenibus subsericieis atque glabrescentibus. Folia elliptica usque oblongo-elliptica 5–15 cm. longa 2–6 cm. lata apice rotundata usque acuta vel acuminata basi acuta chartacea supra et subtus puberulentia et glabrescentia, venis primariis lateralibus arco-ascendentibus; petiolo 2–5 mm. longo. Inflorescentia mascula umbelliformis; pedunculo primario 1.5–3.0 cm. longo; rhachide 2–5 mm. longo; pedunculis secundariis 1–2 mm. longis. Flores masculi 20–55 per inflorescentia; pedicello 3–4 mm. longo; calyce obconico 5–6 mm. longo 2–3 mm. lato extus strigilloso intus glabro; calycis lobis subequalibus intus pubescentibus 1.5–2.5 mm. longis ca. 1.5 mm. latis; petalis in annulum brevissimum connatis; staminibus in planis 2, antheris suborbicularibus 0.5–1.0 mm. longis 0.5–0.75 mm. latis sessilibus; disco cupuliformi ca. 1 mm. alto lobato glabro; pistillodio lageniformi ca. 1.5 mm. longo pubescente. Inflorescentia feminea umbelliformis; pedunculo primario 1.0–1.5 cm. longo; rhachide 2–3 mm. longo; pedunculis secundariis 1–2 mm. longis. Flores feminei 7–20 per inflores-

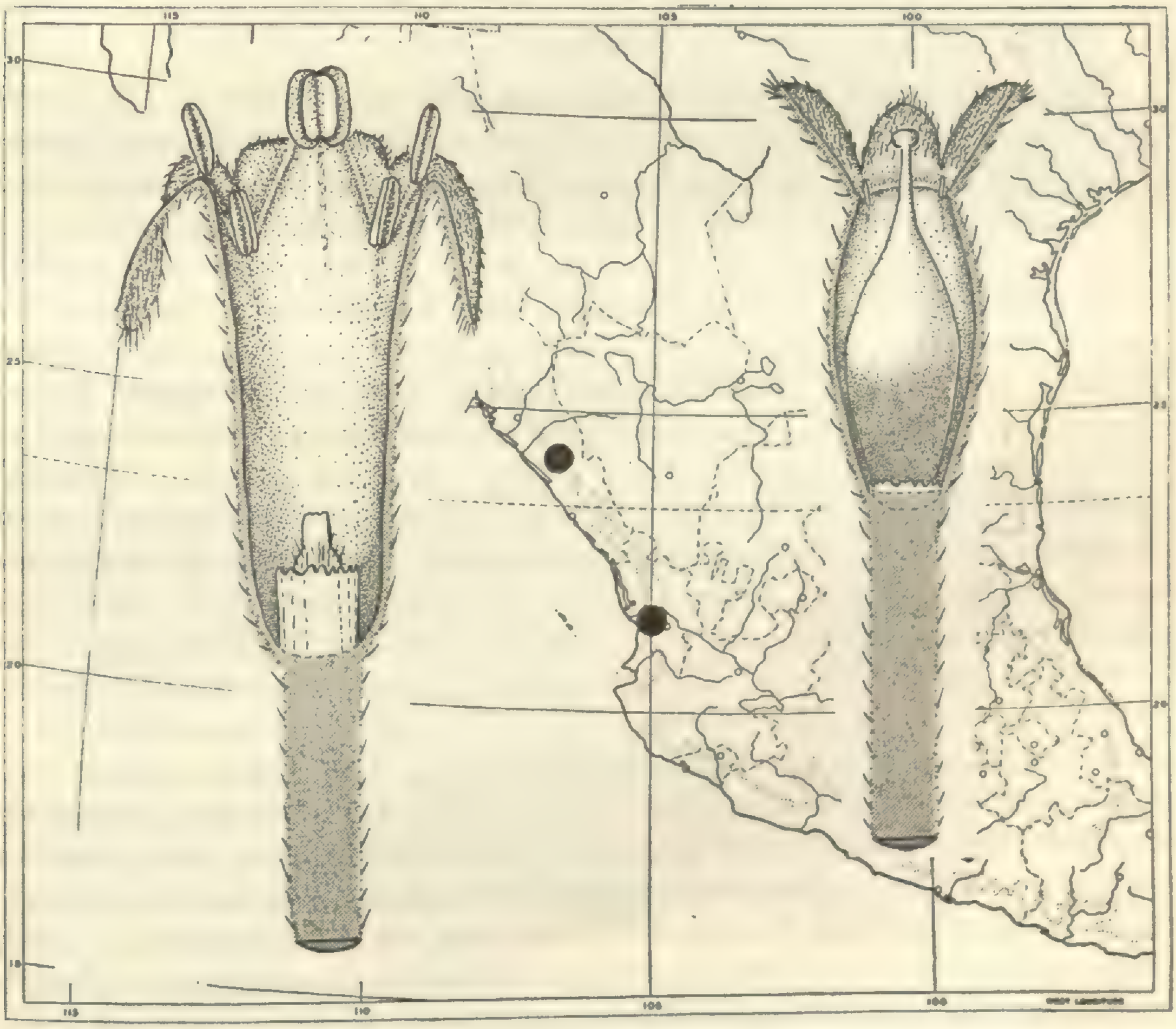

Fig. 20. *Daphnopsis mexiae*

centia; pedicello 3–5 mm. longo; calyce urceolato ca. 3.5 mm. longo 1 mm. lato extus strigilloso intus glabro; calycis lobis subequalibus intus pubescentibus 1.0–1.5 mm. longis et latis; petalis in annulum brevissimum connatis; staminodiis 8 subfiliformibus; disco cupuliformi adnato subtus glabro; pistillo 4.0–4.5 mm. longo ovario obovato glabro stigmate capitato exserto. Fructus ovatus ca. 10 mm. longus 6 mm. latus. HOLOTYPUS: *Mexia 618* (MO).

Collected at altitudes from 1000 to 1500 meters. Known to flower in September.

MEXICO: NAYARIT: road from Tepic to Jalcocotan, *Mexia 618* [(♂) A, F, GH, MO, US], *McVaugh 12110* [MICH (♀)]. SINALOA: Sierra Tacuichamona summit, *Gentry 5682* [GH (♀)].

This new species, named in memory of Mrs. Ynes Mexia, is quite distinct from other Mexican species in which the petals are connate into an obscure faucal annulus. In the staminate flowers the rather long pedicel, the pubescent, lageniform pistillode and the cupuliform disc are all distinctive features. The pistillate flowers are distinctive because of the rather long pedicel and the subfiliform staminodia.

16. DAPHNOPSIS GUACACOA Wr. ex Griseb. Cat. Pl. Cub. 110. 1866. [T.: *Wright 2579* (♂ ♀)!]

Shrubs to 1 m. tall, the young branches strigillose and glabrescent. Leaf blades elliptic to obovate, 2.0–6.5 cm. long, 1.0–3.5 cm. broad, retuse at the apex, cuneate at the base, glabrous above, strigose and glabrescent below, the costa more or less plane above, emersed below, the primary lateral veins obscure above, prominulous below, arcuate-ascending, the margin retuse; petiole 1–6 mm. long. Inflorescences borne from the young leafy or bracteate stems, umbelliform, subsericeous, the primary peduncle 1–5 mm. long, the rhachis at most 2 mm. long, the secondary peduncles at most 1 mm. long. Staminate flowers: 5–10 per inflorescence; pedicel about 2 mm. long; calyx tube obconic, about 4.5 mm. long, 1.5–2.0 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, about 1.5 mm. long, 1.0–1.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted slightly above the orifice, exserted, the alternisepalous inserted almost two anthers' lengths below the orifice, included, the anthers oblong, 0.75–1.0 mm. long, 0.5 mm. broad, subsessile; disc annular, free, about 0.25 mm. tall, slightly lobed, glabrous; pistillode tenpin-shaped, 1.0–1.5 mm. long, glabrous. Pistillate flowers: 2–3 per inflorescence; pedicel 1–2 mm. long; calyx tube campanulate to suburceolate, about 2 mm. long, 1 mm. broad, puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, about 1.5 mm. long, 1.0–1.25 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform, obscure; disc annular, free, less than 0.25 mm. tall, undulate; pistil 2–3 mm. long, the ovary fusiform to ovoid, glabrous, the style about 1 mm. long, the stigma capitate, exserted. Drupe ellipsoid, 9–10 mm. long, about 4 mm. in diameter, glabrous.

Known to flower in December.

Fig. 21. *Daphnopsis guacacoa*

CUBA: PINAR DEL RÍO: Rangel, *Bro. Alain & Killip 2007* [(♀) MO, US]; San Cristobal, *Wright 2579* [GH (♂♀), M (♂♀), MO (♂♀), NY (♂), P (♂♀), S (♂), US (♂)].

The leaves of this species are very similar to those of *D. angustifolia* and *D. cuneata.*

A rather dense fibrous network can be obtained from the bark of this shrub; this network is composed of phloem fibers.

17. DAPHNOPSIS CRASSIFOLIA (Poir.) Meissn. in DC. Prod. 14:524. 1857.

Daphne crassifolia Poir. Encycl. Method. Bot. Suppl. 3:316. 1813. [T.: *Nectoux s. n.* (♂)!]
Daphnopsis crassifolia var. *eggersii* Krug & Urb. in Engl. Bot. Jahrb. 15:350. 1892. [T.: *Eggers 2317*]
Hyptiodaphne crassifolia (Poir.) Urb. in Symb. Ant. 2:454. 1901.
Hyptiodaphne crassifolia var. *β. eggersii* (Krug & Urb.) loc. cit. 455. 1901.

Shrubs or trees, the young branches densely ochraceous-hirsute and glabrescent. Leaves approximately whorled by irregular condensation, 3–4 per whorl; leaf blades elliptic to oblanceolate, 3–5 cm. long, 1–2 cm. broad, acute at the apex, cuneate to subauriculate at the base, coriaceous, densely ochraceous-sericeous and glabrescent above and below, the costa plane to immersed above, emersed below, the primary lateral veins obscure above, prominent below, arcuate-ascending; petiole 2–4 mm. long. Inflorescences borne terminally from the young bracteate stems, umbelliform to subracemiform, hirsute, the primary peduncle 10–20 mm. long,

the rhachis about 1 mm. long, the secondary peduncles 3–7 mm. long. Staminate flowers 2–3 per inflorescence; pedicel obsolete; calyx tube tubular to broadly obconic, 9–10 mm. long, 2.0–4.5 mm. broad at the orifice, hirsute without, glabrous within; calyx lobes subequal, indefinitely papillate within, 2.5–4.0 mm. long, 1.5–4.0 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted about 2 anthers' lengths below the orifice, included, the anthers oblong, about 1 mm. long, 0.5 mm. broad, sessile; disc of irregular lobes, free, to 1.5 mm. tall, glabrous; pistillode tenpin-shaped, about 1.5 mm. long, glabrous. Pistillate flowers: 2–3 per inflorescence; pedicel about 1 mm. long; calyx tube more or less tubular, about 6.5 mm. long, 2 mm. broad at the orifice, hirsute without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer 3–4 mm. long, about 2.5 mm. broad, the inner about 2.5 mm. long, 2 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform; disc of 4 discrete lobes, free, 1.0–1.25 mm. tall, glabrous; pistil tenpin-shaped, about 4.5 mm. long, the ovary glabrous, the style about 1.5 mm. long, the stigma capitate, included. Drupe not seen.

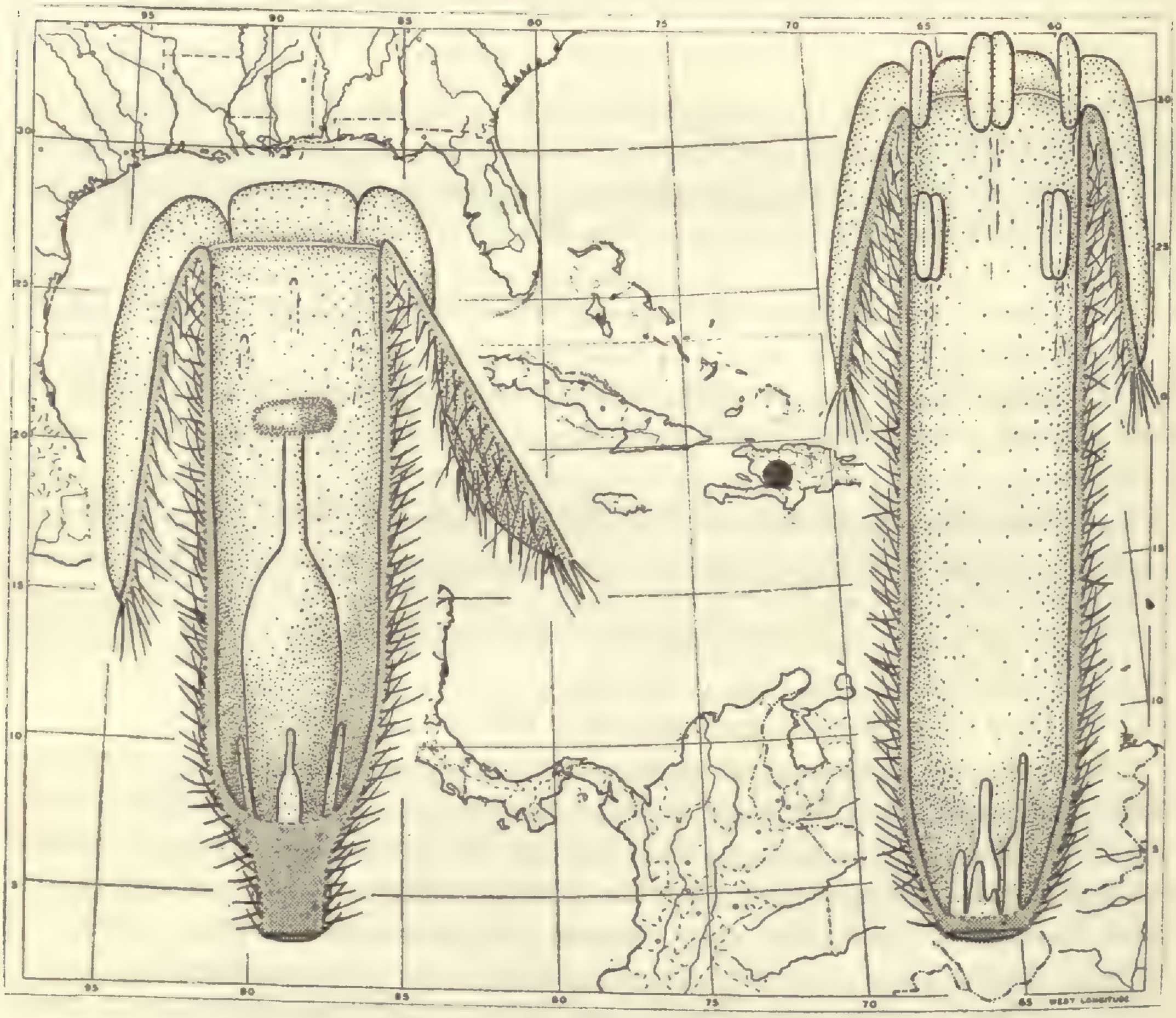

Fig. 22. *Daphnopsis crassifolia*

According to Ekman this species is found on limestone. It flowers from January to May and is reported only from a single altitude, 600 meters.

DOMINICAN REPUBLIC: La Revellue (?), *collector unknown, s. n.* [C (♀)]; without precise locality, *Nectoux s. n.* [P (♂)].

HAITI: ARTIBONITE: Massif du Nord, Hinche, *Ekman H11641* [NY (♂)]. WITHOUT PRECISE LOCALITY: M. des Commissaires, *Holdridge 951* [MO (♀)].

This rare species is known from only a few collections, some of which are fragmentary. The pistillate flowers are rather unusual for the genus because of the included stigma.

The shape of the calyx tube of the staminate flower is rather variable, from tubular to broadly obconic, and appears to be a function of the diameter of the orifice. There appears to be no good reason to recognize varieties on this basis. The same degree of variability is not found in the pistillate flowers.

The irregular condensation of internodes to form leafy whorls at once distinguishes *D. crassifolia* and the following species, *D. philippiana*, from all other species of the genus. Since the flowers are so strikingly different I am inclined to believe that they are not closely related.

18. DAPHNOPSIS PHILIPPIANA Krug & Urb. in Engl. Bot. Jahrb. 15:348. 1892.
[T.: *Sintenis 299* (♀)!]

Shrubs or trees to 10 m. tall, the branches glabrescent. Leaves approximately whorled by irregular condensation, 3–6 per whorl, the leaf blades elliptic to oblanceolate, 4.0–13.5 cm. long, 2.0–6.5 cm. broad, acute to subcaudate-acuminate

Fig. 23. *Daphnopsis philippiana*

at the apex, subauriculate at the base, thin-coriaceous, sericeous and glabrescent above and below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending, the margin slightly revolute; petiole 3–7 mm. long. Inflorescences borne terminally, generally immediately above the last leaf whorl of last year's growth, umbelliform, with many bud scales at the base, sericeous, the resumption of growth is by the development of the axillary buds of the subtending leaf whorl, these axillary branches continuing vegetative growth or becoming floriferous. Staminate inflorescence with the primary peduncle 1.5–18.0 mm. long, the rhachis about 0.5 mm. long, the secondary peduncles about 1 mm. long. Staminate flowers: 6–7 per inflorescence; pedicel 0.5–1.0 mm. long; calyx tube narrowly to broadly obconic, 3.5–6.5 mm. long, 1.0–2.5 mm. broad at the orifice, sericeous without, glabrous within; calyx lobes subequal, indefinitely papillate within, 1.5–3.0 mm. long, 1.25–2.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted at the orifice, subexserted to exserted, the alternisepalous inserted about two anthers' lengths below the orifice, included, the anthers oblong or suborbicular, 0.5–1.0 mm. long, 0.5 mm. broad, subsessile; disc cupuliform, basally adnate, 0.5–0.75 mm. tall, glabrous, the free margin irregularly lobed; pistillode tenpin-shaped, 0.5–1.0 mm. long, glabrous. Pistillate inflorescence with the primary peduncle 2–14 mm. long, the rhachis about 1 mm. long, the secondary peduncles about 1 mm. long. Pistillate flowers: 7–10 per inflorescence; pedicel about 1 mm. long; calyx tube suburceolate, about 3.5 mm. long, 1.5 mm. broad at the orifice, sericeous without, glabrous within; calyx lobes subequal, indefinitely papillate within, about 1 mm. long, 1 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform; disc cupuliform, basally adnate, about 0.75 mm. tall, irregularly lobed, glabrous; pistil about 5 mm. long, the ovary ovoid, glabrous, the style 1.5–2.0 mm. long, the stigma capitate, greatly exserted. Drupe ovoid, 8–14 mm. long, about 4 mm. in diameter, glabrous, white.

Apparently restricted to mountainous regions which are well forested. The range is probably becoming increasingly more restricted by agriculture.

Collected at altitudes of 500 to 1000 meters. Flowers from March to late August.

PUERTO RICO: AGUADILLA: Río Maricáo, *Sintenis s. n.* [A (♀)], *299* [A (♂), F (♂), M (♀), MO (♀), NY (♀), US (♀), W (♀)]; Maricáo to Monte Alegrillo, *Britton, Stevens & Hess 2617* [(?) NY, US]. ARECIBO: Mount Morales, near Utuado, *Britton & Marble 1087* [F (♀), NY (♂♀), US (♀)]. HUMACAO: Sierra de Luquillo, *Sintenis s. n.* [A (?)], *1611* [C (♀), P (?), S (?)]; Loma Icaco, *Shafer 3453* [F (?), NY (♂), US (?)]; Río Icaco and adjacent hills, *Shafer 3525* [(♂) F, MO, NY, US]; El Yunque, *Sargent 528* [US (♂)], *Gleason & Cook M41* [NY (♀)]; Barrio de Maizales, *Britton & Hess 2283* [(?) NY, US]; La Mina Basin, *Horn 43* [NY (♂♀)]; Catalina-Yunque trail, Luquillo Mts., *Britton & Bruner 7552* [NY (♂)]; Sierra de Naguabo, *Sintenis 5320* [U (♂)]. PONCE: Monte Cerrote, near Adjuntas, *Britton & Brown 5432* [(♂) A, F, MO, NY, US]; Alto de la Bandera, near Adjuntas, *Britton & Shafer 2100* [(♀) F, NY, US], *Stevens 4631* [NY (?)]; Mount Mandios, near Jayuya, *Britton & Cowell 951* [(♀) F, NY, US]; Las Cruces, near Adjuntas, *Sintenis 4099* [(♀) A, US, W]; about Adjuntas, Guaraguas, *Sintenis 4354* [C (?)]. WITHOUT PRECISE LOCALITY: *Plee s. n.* [P (♀)]; San Narciso, *Britton & Britton 7279* [A (♂), NY (♂), US (?)]; Quebrada Grande to Cuchilla Firme, *Shafer 3588* [F (?), MO (♂), NY (♂), US(♂)].

Known as *majagua de sierra*. The bark is often used for making rope.

There appears to be considerable variation in the size and shape of the staminate calyx tube although the proportions remain relatively constant. Whether the same condition occurs in the pistillate flowers I am unable to say because of the general lack of flowering material. The number of leaves in any whorl is extremely variable even on the same branchlet.

This species is readily distinguishable from all other species except *D. crassifolia* on the basis of the irregularly whorled leaves.

I have chosen *Sintenis 299* (W) as the lectotype.

19. Daphnopsis brasiliensis Mart. & Zucc. in Nov. Gen. & Sp. 1:65. 1824. [T.: *Martius s. n.* (♂)!]

Daphnopsis dioica Mart. ex Meissn. in Mart. Fl. Bras. 5[1]:66. 1895, as syn.
Daphnopsis mello-barretoi Standl. in Field Mus. Publ. Bot. 22:92. 1940. [T.: *Mello Barreto 7556* (♀)!]

Shrubs or trees, the young branches tomentose and glabrescent. Leaf blades elliptic or oblanceolate to obovate, 3–12 cm. long, 1.5–4.0 cm. broad, acute to rotund at the apex, cuneate-attenuate at the base, subcoriaceous, tomentose and glabrescent above, tomentose below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 3–7 mm. long. Inflorescences borne from the young leafy or bracteate stems, umbelliform. Staminate inflorescence with the primary peduncle 0.5–1.5

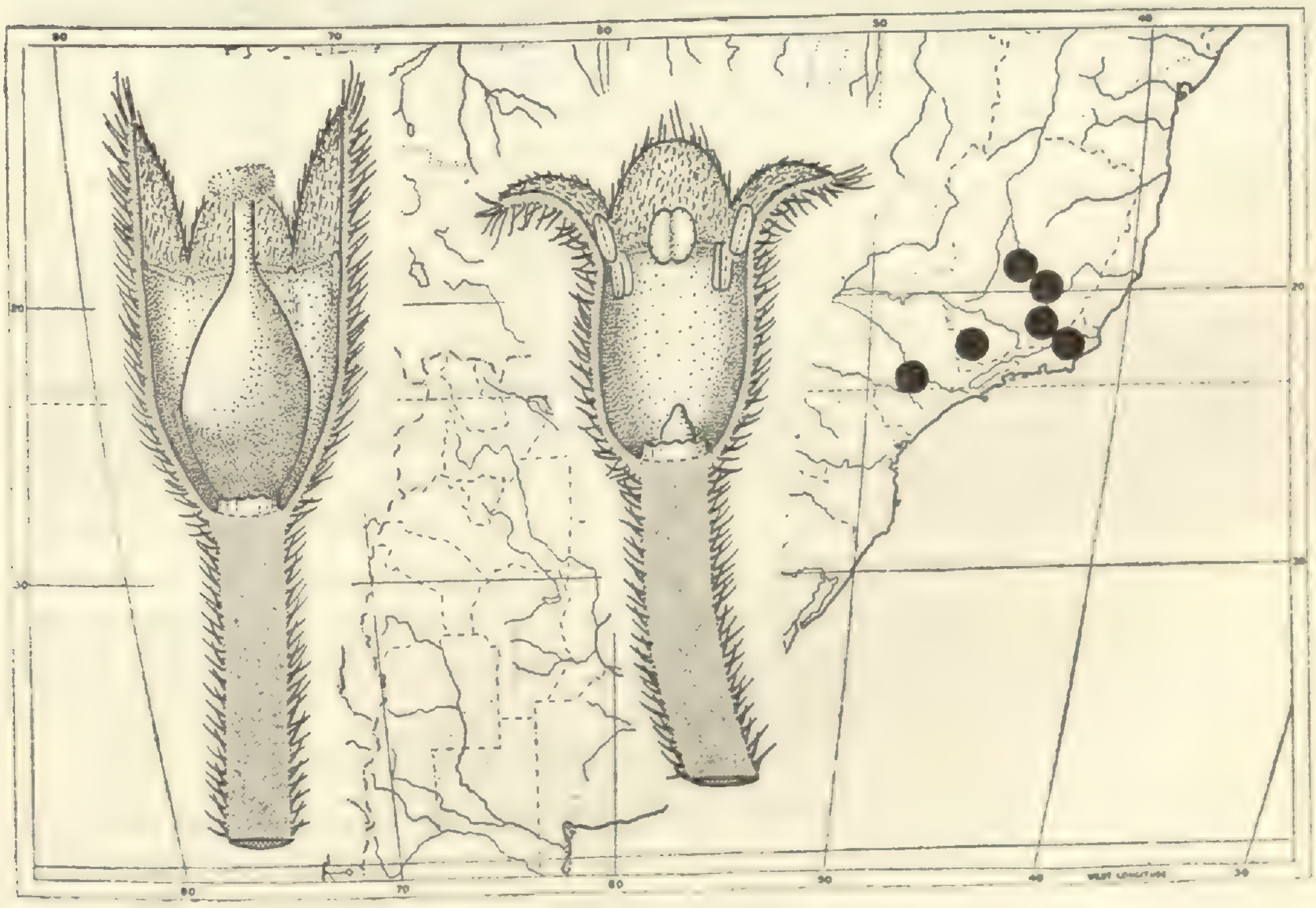

Fig. 24. *Daphnopsis brasiliensis*

cm. long, the rhachis 1–2 mm. long, the secondary peduncles 0.5–2.0 mm. long. Staminate flowers: 15–50 per inflorescence; pedicel 2.5–3.0 mm. long; calyx tube subcampanulate to campanulate, 2.0–2.5 mm. long, ca. 1.5 mm. broad at the orifice, tomentose without, glabrous within; calyx lobes unequal, puberulent within, the outer about 1.5 mm. long, 1 mm. broad, the inner 1 mm. long, 1.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted just below the orifice, included, the anthers suborbicular, about 0.5 mm. long and broad, sessile; disc annular, free, about 0.25 mm. tall, undulate, glabrous; pistillode bottle-shaped, about 0.5–1.0 mm. long, glabrous. Pistillate inflorescence with the primary peduncle 3–5 mm. long, the rhachis about 1 mm. long, the secondary peduncles 0.5–1.0 mm. long. Pistillate flowers: 2–5 per inflorescence; pedicel 1–3 mm. long; calyx tube campanulate, about 2.5 mm. long, 1.5–2.0 mm. broad at the orifice, tomentose without, glabrous within; calyx lobes unequal, puberulent within, the outer about 1.5 mm. long and broad, the inner 0.75 mm. long, 1 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform; disc annular, free, about 0.25 mm. tall, undulate, glabrous; pistil 3.0–3.5 mm. long, the ovary ovoid, glabrous, the style about 0.75 mm. long, the stigma capitate, exserted. Drupe ovoid to ellipsoid, 9–11 mm. long, 5–7 mm. in diameter, glabrous.

Brasil: minas geraes: Caldas, *Mosén 1930* [S (♀)], *994* [P (♂), S (♂♀)]; *Regnell II 127 1/2* [C (♀), F (♂), M (♀), P (♂♀), S (♂), U (♀), US (♀)], *1411a* [R (♀)]; Cambuquira, *Barreto 7557* [(♂) F, R]; Bello Horizante, *Barreto 7556* [F (♀)]; Regod-'Agna, between Aijuruoca & Cachamléu, *Glaziou 16318* [C (♀), P (♂)]; around Rio Paraopeba, *Warming 730* [C (♀)]; Contendas, *Martius s. n.* [M (♂)]; without precise locality, *Martius s. n.* [M (♂)], *Widgren 223* [S (♂)], *1004* [GH (♂), S (♂♀), US (♀), W (♂)], *s. n.* [S (♂♀)]; Ouro Brana, *Porto 474* [MO (?)]; Congon La do Campos, *Damazio s. n.* [MO (♂)]. rio de janeiro: Nova Friburgo, *Glaziou 17201* [(♂) C, F, P, US]; Teresopolis, *Ule 4289* [R (♂)]. são paulo: Serra da Mantiqueira, terras do Cruzeiro do Sr. Major Novaes, *Saldanha 8868* [R (♂)]; in Morro do Lobo, *Martius s. n.* [M (♂)]; without precise locality, *Gaudichaud s. n.* [P (♂)]. without precise locality: *Sello 264* [C (♂), NY (♀), P (♂), US (♂♀)], *s. n.* [B (♂)].

According to Barreto the common names of this species are *embira toicinheira* and *embira amarella.* Flowers in December and January.

Daphnopsis mello-barretoi Standley is a pistillate fruiting specimen. The fruits are not distinct from those of *D. brasiliensis.* Standley believes that the difference between these two "species" is primarily one of leaf shape. At best, vegetative characteristics are a poor basis for species delimitation, especially in tropical plants. It is true that the Barreto specimen has obovate leaves with a more or less rotund apex but I interpret this as one extreme of the leaf variability of a single species. However, the leaves of the Barreto specimens are mostly immature and would be expected to change shape with maturity.

20. Daphnopsis angustifolia Wr. ex Griseb. Cat. Pl. Cub. 110. 1866. [T.: *Wright 2580* (♂)!]

Shrubs to 1 m. tall, the young branches glabrous. Leaf blades obovate or

oblanceolate, 1.0–2.5 cm. long, 0.3–0.6 cm. broad, acute to obtuse at the apex, cuneate at the base, glabrous above and below, the costa plane above, emersed below, the primary lateral veins obscure above and below, margin revolute; petiole 2–3 mm. long. Inflorescences borne from the young leafy stems, umbelliform, the primary peduncle less than 0.25 mm. long, the rhachis about 0.25 mm. long, the secondary peduncles 0.25 mm. long. Staminate flowers: 2–4 per inflorescence; pedicel 1–2 mm. long; calyx tube obconic, 2–3 mm. long, about 1.5 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, puberulent within, 1.5 mm. long, 0.5–0.75 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted immediately above the orifice, subexserted, the alternisepalous inserted less than two anthers' lengths below the orifice, included, the anthers oblong, 0.5–0.75 mm. long, 0.5 mm. broad, sessile; disc annular, free, about 0.25 mm. tall, undulate, glabrous; pistillode tenpin-shaped, 0.75 mm. long, glabrous. Pistillate flowers and fruit not seen.

Fig. 25. *Daphnopsis angustifolia*

CUBA: ORIENTE: versus Pinal Mayari, *Wright 2580* [(♂) A, M, MO, NY, P].

This species appears to be closely related to both the preceding and the following species but the extent of relation cannot be accurately determined because of lack of pistillate material. The principal reason I have maintained *D. angustifolia* as a species distinct from *D. cuneata* is the presence of the free, annular disc.

21. DAPHNOPSIS CUNEATA (Griseb.) Radlk. in Sitzb. Acad. Muenchen 14:489. 1884.

Bumelia cuneata Griseb. Cat. Pl. Cub. 164. 1866. [T.: *Wright 2920* (♀)!] not Swartz.

Shrubs or small trees, the young branches glabrous. Leaf blades ovate or elliptic to obovate, 1–11 cm. long, 1–6 cm. broad, rotund to acute at the apex, cuneate at the base, subcoriaceous to coriaceous, glabrous above and below, the costa plane above, emersed below, the primary lateral veins prominulous above and below, revolute; petiole to 5 mm. long. Inflorescences borne terminally from the young leafy stems or sometimes from an axillary brachyblast, umbelliform, minutely puberulent, the primary peduncle 0.25–3.0 mm. long, the rhachis about 0.25 mm. long, the secondary peduncles less than 0.25 mm. long. Staminate flowers: 1–5 per inflorescence; pedicel 1–5 mm. long; calyx tube more or less narrowly obconic, 2.5–4.5 mm. long, 1.0–1.5 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, minutely puberulent within, about 1.5 mm. long, 1.25–1.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted about two anthers' lengths below the orifice, included, the anthers oblong, 0.5–1.0 mm. long, 0.5 mm. broad, sessile; disc annular, basally adnate, undulate, glabrous; pistillode tenpin-shaped, 1.0–1.5 mm. long, glabrous. Pistillate flowers: 3–4 per inflorescence; pedicel 1–2 mm. long; calyx tube suburceolate, 2.5–3.0 mm. long, 1.0–1.5

Fig. 26. *Daphnopsis cuneata*
Large dots: ssp. *cuneata*, small dots: ssp. *uniflora*.

mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, puberulent within, 1.5 mm. long, 0.5–0.75 mm. broad; petals connate into an obscure faucal annulus; staminodia absent; disc completely adnate; pistil 2–3 mm. long, the ovary ovoid, glabrous, the style about 1 mm. long, the stigma capitate, exserted. Drupe ovoid, about 10 mm. long, 5 mm. in diameter, white.

Specimens of this species are often festooned with lichens and epiphytic bromeliads.

KEY TO THE SUBSPECIES

a. Primary peduncle to 2 mm. long; staminate flowers 3–5 per inflorescence, the calyx tube narrowly obconic, to 3.5 mm. long. Plants of Cuba.....21a. D. CUNEATA CUNEATA

aa. Primary peduncle to 3 mm. long; staminate flowers 1 per inflorescence, the calyx tube obconic, to 4.5 mm. long. Plants of Haiti.....21b. D. CUNEATA UNIFLORA

21a. Daphnopsis cuneata ssp. cuneata

Plants of Cuba, found at altitudes of 800–1300 meters.

Cuba: oriente: Loma Cardero, S. Maestra, *Roig & Bucher 666* [NY (s)], *6904* [NY (s)]; S. Maestra, on the water divide between Río Yara and Río Palmamocha, *Ekman 14432* [S (♀)]; near Palua Mocha peak, *Bro. León 10900* [NY (s)], *10901* [NY (s)]; between Punta de Palmamocha and Pico Turquino, *Ekman 2554* [S (s)]; Loma Barbi, *Ekman 15649* [(♀) NY, S]; north slope of Punta de Palmamocha, *Ekman 14298* [K (?), S (s)]; Monte Libanon, near Monterus, *Ekman 14833* [S (s)]; Sierra de Nipe, in "carra scales" around Río Pilato, *Ekman 2726* [(s) NY, S]; Farallones, *Wright 2920* [(♀) GH, M, MO, NY, P]; Sierra de Imais, Puntón de Mate, *Bro. León 12220* [MO (?), NY (♂)].

This subspecies is rather variable, particularly in leaf size and to lesser degree in leaf shape. The type specimen is small-leaved and the internodes are extremely short; on the other hand a large number of specimens are rather large-leaved and have very long internodes. Whether these differences are due to edaphic factors or are manifestations of juvenile form is impossible to determine from herbarium specimens. With the specimens cited above, a complete transition series between the small-leaved and large-leaved plants can be demonstrated. The specimens with large leaves have been confused with the genus *Lagetta*. Bro. Alain,[12] discussing this genus in Cuba, says, "Una serie de ejemplares estériles de la Sierra Maestra (*León 10900 y 10901*; *Roig & Bucher 6666 y 6904*; *Acuña 9874 y 15160*) pertenecen problamente a una espécie no descrita de este género." Critical collections of Ekman, deposited at Stockholm, have yielded both staminate and pistillate flowers. These flowers were practically identical with those of the type specimen except in size. More important, however, is that they did not have the long-haired ovary or peculiar stigma that typify the genus *Lagetta*.

21b. Daphnopsis cuneata ssp. **uniflora** (Urb. & Ekm.) Nevl. comb. & stat. nov.

Daphnopsis uniflora Urb. & Ekm. in Arkiv. Bot. 21a[5]:16. 1927. [T.: *Ekman H4584* (♂)!]

Plants of Haiti, known only from the type collection. Collected in flower in August at 1000 meters.

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[12] Flora de Cuba 3:385. 1953.

HAITI: NORD-OUEST: Port de Paix, Haut-Piton, *Ekman H4584* [S (♂), US (s)].

The floral morphology of the staminate flower agrees essentially with that of *D. cuneata* ssp. *cuneata* and there seems to be no good reason to maintain both as species.

22. DAPHNOPSIS AMERICANA (Mill.) J. R. Johnston, in Contrib. Gray Herb. n. s. 34:242. 1909; Urban in Arkiv. für Botan. 17[7]:44. 1921, made as a new combination but improperly so; Fawcett & Rendle, in Journ. Bot. 63:51. 1925, made as a new combination but improperly so.

Laurus americana Mill. Dict. ed. 8, no. 10. 1768. [T.: *Houston s. n.*]

Shrubs or trees to 15 m. tall, the young branches ochraceous-tomentellose or sericeous and glabrescent. Leaf blades lanceolate, oblong-elliptic, elliptic, oblanceolate or obovate, 3–21 cm. long, 1–8 cm. broad, blunt to acute, acuminate or subcaudate-acuminate at the apex, cuneate at the base, thin-coriaceous, sericeous to glabrescent above and below, the costa plane above, emersed below, the primary lateral veins prominulous to prominent above and below, arcuate-ascending; petiole 2–10 mm. long. Inflorescences borne from the young portions, simple or dichotomously proliferated, when simple the resumption of vegetative growth through a precocious terminal bud coordinate with the inflorescence, when dichotomously proliferated the resumption of vegetative growth through a subordinate axillary bud, dichotomies 1 to 9, subsericeous, umbelliform to subracemiform. Staminate inflorescence with the primary peduncle 2–45 mm. long, the rhachis 1–8 mm. long, the secondary peduncles 0.5–3.0 mm. long. Staminate flowers: 8–75 per inflorescence; pedicel 1.5–8.5 mm. long; calyx tube more or less tubular, sometimes somewhat inflated basally, 2–5 mm. long, 1–2 mm. broad at the orifice, strigillose to puberulent without, glabrous within; calyx lobes subequal, puberulent within, 1.0–2.5 mm. long and broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted slightly above the orifice to about an anther's length above, exserted, the alternisepalous inserted at the orifice, included to subexserted, the anthers suborbicular to oblong, 0.5–1.0 mm. long, 0.5–0.75 mm. broad, sessile or subsessile; disc annular to cupuliform, basally to completely adnate, irregularly short-lobed, glabrous; pistillode obovoid or tenpin-shaped, 1–2 mm. long, glabrous or minutely setose towards the apex. Pistillate inflorescence with the primary peduncle 2–30 mm. long, the rhachis 1–3 mm. long, the secondary peduncles 0.25–1.0 mm. long. Pistillate flowers: 10–30 per inflorescence; pedicel 0.5–7.0 mm. long; calyx tube obconic, campanulate, suburceolate or urceolate, 1.5–2.5 mm. long, 1.0–1.5 mm. broad at the orifice, strigillose or puberulent without, glabrous within; calyx lobes subequal, puberulent within, 1.0–1.5 mm. long, 0.75–1.5 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform or bearing poorly developed anthers; disc annular to cupuliform, basally to completely adnate, irregularly short-lobed, glabrous; pistil 1–3 mm. long, the ovary ovoid, glabrous, the stigma capitate, included or exserted. Drupe more or less ovoid, 6–15 mm. long, 3–9 mm. in diameter, glabrous.

This is the most widespread species of the genus; it is found in Central Amer-

Fig. 27. *Daphnopsis americana*

Solid dots: ssp. *americana*, checkered dots: ssp. *salicifolia*, dots with superimposed diagonal lines: ssp. *guatemalensis*, dots with superimposed crosses: ssp. *ecuadorensis*, squares: ssp. *cestrifolia*, triangles: ssp. *tinifolia*, crosses: ssp. *caribaea*.

ica, northern South America and in the Greater and Lesser Antilles. The plants are generally associated with rivers, streams or other very moist habitats such as cloud forests. They show a pronounced preference for soils which are volcanic in origin.

The species is extremely variable and, as a result, has a large and complex synonymy. A large number of specimens are now available and a general reorganization is possible.

Urban's new combination, *D. americana* (Mill.) Urb., was made with the intention of including specimens from Jamaica and Hispaniola. Later, Fawcett and Rendle discussed some of the taxonomic confusion in the species and added to that confusion with a new combination. The new combination, *D. americana* (Mill.) Fawcett & Rendle, was based on the Houston specimen from Veracruz

which was previously described as *Laurus americana* Mill. (deposited at BM as late as 1925 but cannot be located at present). The combination was made so that the name would be fixed with the Mexican specimen since Johnston had previously made the same combination for specimens from Margarita and the Antilles. This confusion stems from the belief that the Mexican and Antillean specimens represented separate species which they do not. Johnston's combination is valid and would apply to the Mexican specimens whether his cited specimens were included in that species or not and the later combinations of Urban and Fawcett & Rendle are superfluous.

I am recognizing seven subspecies which are based on certain morphological disjunctions as well as some less well-defined geographical disjunctions.

KEY TO THE SUBSPECIES

a. Calyx tube shorter than the pedicel; pistillode glabrous or minutely setose at the apex.
  b. Pedicel slightly longer than the calyx tube or rarely in ssp. *guatemalensis* the pedicel to 3 times as long as the pistillate calyx tube; pistillode glabrous or minutely setose at the apex.
    c. Leaves obovate to oblanceolate or oblong-elliptic; staminate inflorescence with the primary peduncle 4–35 mm. long, the rhachis 1–8 mm. long; staminate flowers with the calyx lobes never as long as the tube, the disc basally to completely adnate, the pistillode glabrous or minutely setose at the apex; pistillate inflorescence with the primary peduncle 2–25 mm. long; pistillate flowers with the calyx tube obconic, campanulate or suburceolate, the disc basally to completely adnate, the stigma included or exserted, the drupe 8–14 mm. long.
      d. Staminate inflorescence with the primary peduncle 11–33 mm. long, the rhachis 1–4 mm. long; staminate flowers with the disc basally to completely adnate, the alternisepalous stamens included to subexserted, the pistillode glabrous; pistillate inflorescence with the primary peduncle 8–25 mm. long; pistillate flowers with the calyx tube suburceolate, the staminodia papilliform, the stigma exserted. Plants of eastern Mexico.....22a. D. AMERICANA AMERICANA
    dd. Staminate inflorescence with the primary peduncle 2–35 mm. long, the rhachis 1–8 mm: long; staminate flowers with the disc basally adnate, the alternisepalous stamens subexserted, the pistillode glabrous or minutely setose at the apex; pistillate inflorescence with the primary peduncle 2–18 mm. long; pistillate flowers with the calyx tube obconic or campanulate, the staminodia bearing poorly developed anthers, the stigma included.
      e. Staminate inflorescence with the primary peduncle 4–17 mm. long, the rhachis 2–8 mm. long; staminate flowers with the anthers oblong, the pistillode glabrous; pistillate inflorescence with the primary peduncle 3–15 mm. long; pistillate flowers with the calyx tube obconic, the disc completely adnate. Plants of central and western Mexico.....22b. D. AMERICANA SALICIFOLIA
      ee. Staminate inflorescence with the primary peduncle 2–35 mm. long, the rhachis 1–2 mm. long; staminate flowers with the anthers suborbicular, the pistillode minutely setose at the apex; pistillate inflorescence with the primary peduncle 2–18 mm. long; pistillate flowers with the calyx tube campanulate, the disc basally adnate. Plants of Colombia.....22c. D. AMERICANA CESTRIFOLIA
  cc. Leaves elliptic to oblanceolate or rarely obovate; staminate inflorescence with the primary peduncle 8–30 mm. long, the rhachis 1–2 mm. long; staminate flowers with the calyx lobes shorter than the calyx tube or sometimes as long or longer, the disc basally adnate, the pistillode glabrous; pistillate inflorescence with the primary peduncle 4–30 mm. long; pistillate flowers with the calyx tube campanulate to urceolate, the disc basally adnate, the stigma exserted, the drupe 7–15 mm. long.
    f. Leaves elliptic to oblanceolate; staminate inflorescence with the primary peduncle 11–14 mm. long; staminate flowers with the calyx tube about 2 mm. long, the lobes sometimes as long as the tube or longer; pistillate inflorescence with the primary peduncle 4–30 mm. long; pistillate flowers with the calyx tube campanulate, the drupe 9–10 mm. long. Plants of southern Mexico and Guatemala. .....22d. D. AMERICANA GUATEMALENSIS

ff. Leaves elliptic to oblanceolate or rarely obovate; staminate inflorescence with the primary peduncle 8–30 mm. long; staminate flowers with the calyx tube 3.5–4.5 mm. long, the lobes shorter than the tube; pistillate inflorescence with the primary peduncle 6–21 mm. long; pistillate flowers with the calyx tube suburceolate to urceolate, the drupe 7–15 mm. long. Plants of Cuba, Jamaica and Hispaniola. .....22e. D. AMERICANA TINIFOLIA

bb. Pedicel regularly twice as long as the calyx tube; pistillode minutely setose at the apex. Plants of Ecuador.....22f. D. AMERICANA ECUADORENSIS

aa. Calyx tube longer than the pedicel or sometimes in material from Costa Rica the pedicel somewhat longer than the calyx tube; pistillode glabrous. Plants of Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Puerto Rico and the Lesser Antilles..... .....22g. D. AMERICANA CARIBAEA

22a. DAPHNOPSIS AMERICANA ssp. AMERICANA

Daphne obovata Humb. & Bonpl. ex Wikstr. Diss. Daphn. ed. 2. 40. 1820. [T.: *Humboldt & Bonpland 7549*]
Daphne bonplandiana HBK. Syn. Pl. Aequin. 1:447. 1822, ex char.
Daphne lagetto Bonpl. ex HBK. loc. cit. 1822, as syn.
Daphnopsis bonplandii (HBK.) Meissn. in DC. Prod. 14:521. 1857, ex char.
Hargasseria mexicana Schiede & Deppe, ex C. A. Meyer, in Bull. Acad. St. Petersbourg 1: 356. 1843; Ann. Sci. Nat. ser. II. 20:51. 1843, (based on *Daphne bonplandiana* Cham. & Schlechtd. not HBK.).
Hargasseria schiedeana Endl. Gen. Suppl. 4^2:68. 1847, (based on *Daphne bonplandiana* HBK.).
Daphnopsis lindenii Meissn. in DC. Prod. 14:523. 1857. [T.: *Linden 95* (♀)!]
Daphnopsis bonplandiana (HBK.) Standl. in Contrib. U. S. Nat. Herb. 23:1013. 1924.

Leaf blades obovate to oblanceolate or oblong-elliptic, 3–11 cm. long, 1.0–3.5 cm. broad, rounded to acute at the apex; petiole 3–6 mm. long. Staminate inflorescence umbelliform, the primary peduncle 11–33 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 0.5 mm. long. Staminate flowers: 10–20 per inflorescence; pedicel 4–7 mm. long; calyx tube narrowly obconic, 2.5–5.0 mm. long, 1.5–2.0 mm. broad at the orifice; calyx lobes 1.5–2.5 mm. long, 1.0–1.5 mm. broad; antisepalous stamens inserted to an anther's length above the orifice, the alternisepalous inserted at the orifice, subexserted to included, the anthers oblong, 0.5–0.75 mm. long, about 0.5 mm. broad, sessile; disc basally to completely adnate, about 0.5 mm. tall, the margin when free irregularly short-lobed, glabrous; pistillode tenpin-shaped, 1.0–1.5 mm. tall, glabrous. Pistillate inflorescence, umbelliform, the primary peduncle 8–25 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 0.5 mm. long. Pistillate flowers: 8–14 per inflorescence; pedicel 3.0–6.5 mm. long; calyx tube suburceolate, 2.0–2.5 mm. long, about 1 mm. broad at the orifice; calyx lobes 1.0–1.25 mm. long, 0.75–1.0 mm. broad; staminodia 8, papilliform; disc as in staminate flowers; pistil about 3 mm. long, the stigma exserted.

This subspecies is apparently restricted to eastern Mexico where it flowers from January to June.

MEXICO: VERACRUZ: Veracruz, *Orcutt 3395* [(♀) F, MO, US], *Purpus 8742* [(♂) BM, US], *Humboldt & Bonpland 4487* [P (♀)], *1746* [F (?), P (♂)], *Müller 33* [NY (♂ ♀)], *Gouin s. n.* [P (♂ ♀)], *Wawra 682* [W (♂)]; Zacuapan, *Purpus 3730* [(♀) A, F, MO, NY, US], *5992* [(♀) A, NY, US], *10677* [M (♂), S (♂ ♀), US (♀)], *15432* [F (♂)]; along Río de Los Pescados, *Purpus 13070* [(♂) A, F]; Medellin, *Wawra 39* [W (♀)]; banks of creek, Puente Nacional, *Purpus 10677*[bis] [C (♂ ♀), MICH (♀)],

10766 [(♂) A, F]; Tlacotalpam, *Nelson 503* [US (♂)]; El Mirador, *Purpus 15332* [MICH (♂)], *16217* [(♂) A, F], *Linden 95* [NY (fragment ♀)], *Liebmann 4291* [(♂) C, F], *4292* [(♀) C, F US], *14837* [(♂) C, F, GH, MO, US]; without precise locality, *Hahn s. n.* [P (♀)], *Schiede & Deppe 86* [(♀) MO, US, W], *s. n.* [(♀) M, NY], *Galeotti 523* [(♂) P, W], *524* [(♂) P, W].

This subspecies has a rather confused synonymy which was precipitated by a failure to communicate adequately the circumscription of the names concerned. Thus Wikstroem described a doubtful species *Daphne obovata* based on a Humboldt and Bonpland specimen. Two years later Humboldt, Bonpland and Kunth described a new species, *Daphne bonplandiana,* under which they placed *Daphne obovata* as a synonym and then fixed the type specimen of that epithet as *Humboldt & Bonpland 7549*. *Daphne lagetto* Bonpland was also published at this time as a synonym. Meissner, in 1857, made the appropriate shift of the epithet into *Daphnopsis*. Meyer then described *Hargasseria mexicana* based on *Daphne bonplandiana* Cham. & Schlechtd. of which I can find no record except as a manuscript name. *Hargasseria schiedeana* was described in 1847 and was based on *Daphne bonplandiana* HBK. and requires no comment. Meissner's description of a new species, *Daphnopsis lindenii,* literally opened the floodgates of error. This species was based on *Linden 95* which Meissner stated as having been collected in Mirades District. Modern collectors i.e., since 1900, unable to find this location and emboldened with the knowledge that the description was very broad, applied the name wholesale to specimens from Mexico and Guatemala, especially to *D. ficina*. It is clear that one of two possible "accidents" has occurred: either a typesetting error was made or Meissner misread the collection place of *Linden 95*. It is clearly Mirador not Mirades. El Mirador is a finca at which few botanists of the time failed to stop for varying periods; it is on the road between Huatusco and Jalapa Enriquez.[13] Standley's combination requires no comment other than to mention that it was improper.

This subspecies shows considerable variation, particularly in leaf shape. Although specimens are too few to make any concrete conclusions, it appears as though specimens collected at Veracruz generally have obovate leaves while those collected farther inland become progressively oblanceolate to oblong-elliptic.

Some confusion may be found among certain Purpus collections. *Purpus 10677* is composed of two collections: those collected at Zacuapan in 1927 and those collected on the banks of a creek at Puente Nacional, in 1932.

22b. DAPHNOPSIS AMERICANA ssp. **salicifolia** (HBK.) Nevl. comb. & stat. nov.

Daphne salicifolia HBK. Nov. Gen. 2:150. 1817. [T.: *Humboldt & Bonpland s. n.* !]
Daphne elaeagnoides Humb. & Bonpl. ex Wikstr. Diss. Daphn. ed. 2. 40. 1820. [T.: *Humboldt 7551* !]
Daphne mexicana Spreng. Syst. 2:236. 1825, (based on *Daphne salicifolia* HBK.)
Hargasseria salicifolia (HBK.) Endl. Gen. Suppl. 4^2:68. 1847.
Daphnopsis salicifolia (HBK.) Meissn. in DC. Prod. 14:522. 1857.

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[13] Information supplied by Dr. Robert Dressler.

Leaf blades oblong-elliptic or elliptic to oblanceolate to rarely obovate, 3–18 cm. long, 1.0–4.5 cm. broad, acute at the apex; petiole 3–5 mm. long. Staminate inflorescence umbelliform to subracemiform, the primary peduncle 4–17 mm. long, the rhachis 2–8 mm. long, the secondary peduncles to 0.5 mm. long. Staminate flowers: 8–35 per inflorescence; pedicel 3–6 mm. long; calyx tube narrowly obconic, slightly inflated at the base, 2.5–4.0 mm. long, 1.0–1.5 mm. broad at the orifice; calyx lobes 1.5–2.5 mm. long, 1.0–1.5 mm. broad; antisepalous stamens inserted just above the orifice, the alternisepalous inserted at the orifice, subexserted, the anthers oblong, 0.5–0.75 mm. long, 0.5 mm. broad, sessile; disc basally adnate, about 0.5 mm. tall, irregularly lobed, glabrous; pistillode tenpin-shaped, 1–2 mm. long, glabrous. Pistillate inflorescence umbelliform to subracemiform, the primary peduncle 3–15 mm. long, the rhachis 1–3 mm. long, the secondary peduncles to 0.5 mm. long. Pistillate flowers: seen only in material from Morelos State; 8–15 per inflorescence; pedicel 0.5–6.0 mm. long; calyx tube obconic, 1.5–2.0 mm. long, about 1 mm. broad at the orifice; calyx lobes 1.0–1.5 mm. long, about 1 mm. broad; staminodia 8, with poorly developed anthers, the antisepalous anthers less developed than the alternisepalous, subsessile; disc completely adnate; pistil 1–2 mm. long, the stigma included. Drupe ovoid, 10–14 mm. long, 5–9 mm. in diameter, white.

Flowers from February through July at altitudes of 500–1000 meters.

MEXICO: GUERRERO: Carreceras, *Hinton 10099* [(♂) GH, MICH, MO, NY, S, U, US]; Vallecitos, *Hinton 10246* [(♂) GH, MICH, MO, NY, US], *10268* [(♀) A, MICH, MO, NY, US]. MÉXICO: Tejupilco, *Hinton 4062* [(♀) A, F, MICH, NY, U, US]; Platanal, *Hinton 3348* [(♂) A, F, S, US]; Acatitlán, *Hinton 3173* [(♂) A, F, NY, S, US]; Tenayac, *Hinton 3313* [(♂) A, US], *4016* [(♀) A, NY, US]. MORELOS: hillsides near Cuernavaca, *Pringle 6328* [A (♂♀), F (♂♀), M (♀), MO (♀), NY (♀), P (♀), S (♀), US (♂♀), W (♀)], *Humboldt & Bonpland s. n.* [F (fragment), P (?)], *Rose, Painter & Rose 10240* [US (♀)]; Salto San Antón, *Lyonnet 346* [(♂) MO, US], *Woronow 2602* [F (♂)], *2727* [F (♂)]; Huanta (?), *Schiede s. n.* [S (♀)]; Xuchicalio (?), *Hahn s. n.* [P (♀)]; Dos Tetecos, *Arsène s. n.* [US (♂)]; Chapultepec, *Williams 3801* [A (♀)]; Xachitepec, *Lyonnet 1488* [A (♂)]; Arlocommlio (?), *Ehrenberg s. n.* [US (♂)]. WITHOUT PRECISE LOCALITY: *Humboldt 7551* [NY (?)].

Known as *cuco* and *manea de torro.*

The specimens from Morelos are rather constant and are identified by their oblong-elliptic, salicaceous leaves. The pistillate flowers are quite conspicuous by their small size but especially by the presence of poorly developed anthers! These flowers are without doubt functionally pistillate since some of them bear fruit. Unfortunately, I have been unable to find pistillate flowers from the states of México or Guerrero.

Some of the staminate specimens show a definite tendency for the primary rhachis to elongate. This condition reaches a climax in *Hinton 10246* (MO) but can be found in any number of specimens.

The inflorescences are generally simple though some of the specimens from Guerrero show the tendency to proliferate dichotomously.

22c. DAPHNOPSIS AMERICANA ssp. **cestrifolia** (HBK.) Nevl. comb. & stat. nov.

Daphne cestrifolia HBK. Nov. Gen. 2:150. 1817. [T.: *Hartweg 1367* (♀)!]
Hargasseria cestrifolia (HBK.) Endl. Gen. Suppl. 4^2:68. 1847.
Daphnopsis cestrifolia (HBK.) Meissn. in DC. Prod. 14:523. 1857.

Leaf blades elliptic to oblanceolate, 3–11 cm. long, 1.5–3.0 cm. broad, acute at the apex; petiole 2–4 mm. long. Staminate inflorescence umbelliform or sometimes subracemiform, the primary peduncle 2–35 mm. long, the rhachis 1–2 mm. long, the secondary peduncles about 0.5 mm. long. Staminate flowers: 14–30 per inflorescence; pedicel 4–6 mm. long; calyx tube narrowly obconic, 3.5–4.5 mm. long, 1.0–1.5 mm. broad at the orifice; calyx lobes about 2.5 mm. long, 1 mm. broad; antisepalous stamens inserted about an anther's length above the orifice, the alternisepalous inserted at the orifice, subexserted, the anthers suborbicular, 0.75 mm. long, 0.5 mm. broad, sessile; disc basally adnate, to 0.5 mm. tall, irregularly lobed; pistillode tenpin-shaped, about 2 mm. long, minutely setose at the apex. Pistillate inflorescence umbelliform, the primary peduncle 2–18 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 0.5 mm. long. Pistillate flowers: based on a single flower: 10 per inflorescence; pedicel 3–4 mm. long; calyx tube campanulate, about 3 mm. long, 1.5 mm. broad at the orifice; calyx lobes about 1.5 mm. long and broad; staminodia 8, with poorly developed anthers; disc basally adnate, irregularly lobed; pistil 2.5 mm. long, the style 1 mm. long, the stigma included. Drupe ovoid, 9–11 mm. long, 5–7 mm. in diameter.

COLOMBIA: CALDAS: Caldas on Ambalema-Ibagué rr., *Haught 2380* [F (♂)]. CUNDINAMARCA: Guaduas, *Karsten s. n.* [W (♀)], *Hartweg 1367* [NY (fragment ♀)], *Humboldt & Bonpland 1746*bis [NY (fragment ♀), P (♀)], *s. n.* [P (♂)]. TOLIMA: between Honda and Mariquita, *Barriga 8172* [US (♂ ♀)]; above Honda, around Piedras, *Holton 288* [NY (?)]; Mariqueta, *Triana 1065* [P (♂)]; Ibagué, *Goudot 1* [P (♂ ♀)]; forests of El Pital above Tolima, *Lehmann 8713* [(♂) F, NY]; llanos de Tolima, around Ibagué, *Cuatrecasas & Arbelaez 6485* [(♀) F, US]. WITHOUT PRECISE LOCALITY: *Lehmann 909* [NY (♂)], *André 1937* [F (?), NY (♂)].

Known as *barbasquillo* and *pela manos.*

Curiously, some of the same tendencies of the preceding subspecies occur again in this group. The tendency of the rhachis to elongate is to be found in such specimens as *Barriga 8172* (US). Most remarkable, however, is the presence of poorly formed anthers in the pistillate flowers. The inflorescences are generally dichotomized 1 to several times.

The *Humboldt & Bonpland 1746* collection appears to be a split collection, this number appears in collections from Veracruz, Mexico and again in Guaduas, Colombia.

22d. DAPHNOPSIS AMERICANA ssp. **guatemalensis** Nevl. ssp. nov.

Folia elliptica usque oblanceolata 6–16 cm. longa 1–4 cm. lata apice obtusa usque acuminata; petiolo 7–10 mm. longo. Inflorescentia mascula umbelliformis; pedunculo primario 11–15 mm. longo; rhachide 1–2 mm. longo; pedunculis secundariis 0.5 mm. longis. Flores masculi: pedicello ca. 5 mm. longo; calyce obconico ca. 2 mm. longo 1.5 mm. lato; calycis lobis ca. 2.5 mm. longis 2.5 mm. latis;

staminibus in planis 2, antheris oblongis 1 mm. longis 0.5 mm. latis sessilibus; disco adnato, lobato; pistillodio ampulliformi apice quamquam dilatato 1 mm. longo glabro. Inflorescentia feminea umbelliformis; pedunculo primario 4–30 mm. longo; rhachide 1–2 mm. longo; pedunculis secundariis 0.5 mm. longis. Flores feminei: pedicello 4–7 mm. longo; calyce campanulato ca. 2 mm. longo 1.5 mm. lato; calycis lobis 1.25–1.5 mm. longis 1 mm. latis; staminodiis 8 papilliformibus; disco adnato lobato; stigmate exserto. Fructus ovatus 9–10 mm. longus 6–7 mm. latus. HOLOTYPUS: *Aguilar 173* (F).

Flowers from late November to April at altitudes from 300 to 1700 meters.

MEXICO: CHIAPAS: Pan American highway 25 mi. s.e. of Comitán, *Carlson 1962* [(♀) F, MICH]; vicinity and east of Ocozocuautla, *Moore 2524* [A (♂)].

GUATEMALA: ESCUINTLA: without precise locality, *Ruano 992* [US (?)]. GUATEMALA: near Finca La Aurora, *Aguilar 173* [F (♀)]. HUEHUETENANGO: dry slopes between San Ildefonso Ixtahuacán and Ciulco, *Steyermark 50471* [F (s)]; Ciénaga de Lagartero, below Miramar, *Steyermark 51491* [F (s)], *51549* [F (♀)]; above Democracia on trail towards Jutal, *Steyermark 51052* [F (s)]. JALAPA: between Monjos and Jalapa, *Steyermark 32193* [F (s)]. JUTIAPA: between Jutiapa and La Calera, *Standley 76085* [F (s)] between Jutiapa and Las Tunas, *Standley 76248* [(♂) F, NY, US]; between Jutiapa and La Buerrera, *Standley 76011* [F (?)], *76016* [F (?)]; vicinity of Jutiapa, *Standley 32193* [F (s)]. SANTA ROSA: near El Molino, *Standley 78048* [F (s)]. WITHOUT PRECISE LOCALITY: *Ruano 817* [(♀) F, US].

Known in northern Guatemala as *camamán* according to Steyermark and is used for *mecabal* and for tying objects. In southern Guatemala it is known as *chilamatillo* or *capulincito* according to Standley, *llovizna* according to Ruano and *coralillo blanco* according to Aguilar.

22e. DAPHNOPSIS AMERICANA ssp. **tinifolia** (Sw.) Nevl. comb. & stat. nov.

Daphne tinifolia Sw. Prod. Veg. Ind. Occ. 63. 1788, (based on *Laurus americana* Mill.)
Nordmannia tinifolia (Sw.) Fisch. & C. A. Mey. in Bull. Acad. St. Petersbourg 1:355. 1843; Ann. Sci. Nat. ser. II. 20:49. 1843.
Hargasseria tinifolia (Sw.) Endl. Gen. Suppl. 4^2:68. 1847.
Daphnopsis tinifolia (Sw.) Meissn. in DC. Prod. 14:523. 1857, in part; Griseb. Fl. Brit. W. Ind. 278. 1860.
Daphnopsis tinifolia β cumingii Meissn. loc. cit. 1857. [T.: *Cuming 56* (♂)!]

Leaf blades elliptic to oblanceolate or rarely obovate, 6–18 cm. long, 2–8 cm. broad, acute to somewhat acuminate at the apex; petiole 5–10 mm. long. Inflorescences 1–3 times dichotomous, umbelliform. Staminate inflorescence with the primary peduncle 8–30 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 0.5 mm. long. Staminate flowers: 15–25 per inflorescence; pedicel 4.5–8.0 mm. long; calyx tube obconic, 3.5–4.5 mm. long, 1.5–2.0 mm. broad at the orifice; calyx lobes 1.0–2.5 mm. long, 1.0–1.5 mm. broad; antisepalous stamens inserted about an anther's length above the orifice, the alternisepalous inserted at the orifice, included to subexserted, the anthers oblong, about 0.75 mm. long, 0.5 mm. broad, sessile; disc basally adnate, about 0.5 mm. tall, irregularly lobed; pistillode tenpin-shaped, 1.5 mm. long, glabrous. Pistillate inflorescence with the primary peduncle 6–21 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 0.5 mm. long. Pistillate flowers: about 11 per inflorescence; pedicel 2–5 mm. long; calyx tube suburceolate to urceolate, 1.5–2.0 mm. long, about 1

mm. broad at the orifice; calyx lobes 0.75–1.5 mm. long, 0.75 mm. broad; staminodia 8, papilliform; disc as in staminate flower; pistil about 2 mm. long, the stigma exserted. Drupe ovoid, 7–15 mm. long, 7–9 mm. in diameter.

Flowers from June to November, although several specimens from Jamaica are at anthesis in January and February. Found at altitudes from 500 to 1300 meters.

CUBA: ORIENTE: on slope from Arroyo Jiménez to Arroyo Bayaja, *Ekman 14281* [(♂) MO, NY, S]; Puerto Padre, *Curbelo 132* [NY (♂)]; Finca Sabana, Palua Gouano (?), *Curbelo 185* [NY (♀)]; Bazote, Cayo del Rey, *Ekman 4682* [(s) NY, S], *8585* [(s) NY, S]; Manacal, *Ekman 9331* [S (?)], *9385* [(♀) NY, S]; Río Yara, *Ekman 5609* [S (s)]. WITHOUT PRECISE LOCALITY: *De La Ossa s. n.* [NY (fragment ♂)].

JAMAICA: CLARENDON: Round Hill, *Harris 9700* [(♀) F, NY, P, US]; Peckham woodland, *Harris 11084* [(♀) F, NY US]. HANOVER: Dolphin Head, *Britton 2337* [NY (s)]. MANCHESTER: Mandeville and vicinity, *Britton 1666* [NY (♀)]. ST. ANN: Reynold Jamaica Mine lands near Lydford P. O., *Howard & Proctor 13566* [A (♀)], *14024* [A (♀)], *14063* [A (♀)]; Moneague, *Hunnewell 19737* [GH (♂)], *Alexander s. n.* [C (♀), NY (♂ ♀), P (♂ ♀), US (♀), W (♂)]. ST. CATHERINE: Worthy Park, *Harris 11231* [(♀) F, NY, US]. ST. ELIZABETH: along the old road from Retirement to Mountainside, *Howard & Proctor 13711* [A (♂)]; Potsdam to Pedro Plains, *Britton 1201* [NY (♀)]. ST. THOMAS: Blue Mtns., near Abbey Cyreen (?), *Rehder s. n.* [A (♀)]. WESTMORELAND: Hopeton, *Harris 9764* [(♀) F, NY, US]. WITHOUT PRECISE LOCALITY: Latimer, *Hart s. n.* [NY (♂)]; Fairfield, *Cuming 56* [W (♂)], *Wullschlaegel 994* [M (♀)]; Chestervale, *Philipson 727* [MO (♂)]; Cinchona, *Philipson 1066* [MO (♀)]; Clydesdale to Chestervale, *Britton 337* [(♀) F, NY]; *Hart s. n.* [US (♂)], *626* [NY (♂)]; *March s. n.* [(♂ ♀) GH, NY]; *Swartz s. n.* [(♂) NY, S].

HAITI: SUD: around Constant, *Ekman H795* [(♀) A, S] Rivière Glass, *Holdridge 2111* [(♀) MICH, US]; Massif de la Houtte, Gr.-Goave, Trouin, *Ekman H2381* [(♂) NY, S, US].

Known as *guacacoa* or *guacacoa baria* in Cuba, *mahaut* in Haiti and *burn-nose tree* in Jamaica. The bark is used for rope.

Daphne tinifolia of Swartz was plainly based on Miller's *Laurus americana*, a fact which was either ignored by later workers or believed to be in error by them. In either case, Swartz's concept of the species was correct.

It is to be noted that specimens from Puerto Rico are not included in this subspecies. Other species of plants and animals showing the Antillean distribution often have the subspecific distributional limits drawn between Puerto Rico and the Lesser Antilles. This phenomenon is strongly supported by geologic evidence, namely that the islands of Cuba, Jamaica, Hispaniola and Puerto Rico were formed much earlier than those of the lesser Antilles and were at one time continuous. I have included the Puerto Rican specimens in subspecies *caribaea*. The fact that there are no specimens from the Dominican Republic may or may not furnish the answer to this problem. Unfortunately, the Dominican Republic is so poorly collected that it is impossible to determine whether the plants occur there or not; but, if they do not the evidence strongly suggests the establishment of this subspecies in the Greater Antilles at some time *after* the disjunction of Puerto Rico from the remainder of the Greater Antilles and *before* their eventual disjunction. This would mean that the Puerto Rican specimens, as well as those of the Lesser Antilles, migrated to these islands from the south rather than from the north as postulated by Beard.[14] Beard was seriously handicapped by lack of knowledge of the plants in northern South America.

[14] Beard, J. S. Oxford Forestry Memoirs No. 21. 1949.

The De La Ossa specimen is labeled "Havanna" but I seriously doubt its validity, therefore I place it among those specimens without precise locality.

22f. DAPHNOPSIS AMERICANA ssp. **ecuadorensis** (Domke) Nevl. comb. & stat. nov.

Daphnopsis caribaea var. *ecuadorensis* Domke, in Notizbl. 12:727. 1935. [T.: *Eggers 14316* (♂)!]

Leaf blades elliptic to oblanceolate, 6–16 cm. long, 2–5 cm. broad, acute to subcaudate-acuminate at the apex; petiole 4–6 mm. long. Inflorescences 2–3 times dichotomous, umbelliform. Staminate inflorescence with the primary peduncle 1.0–4.5 cm. long, the rhachis 1–3 mm. long, the secondary peduncles 0–3 mm. long. Staminate flowers: 18–30 per inflorescence; pedicel about 8.5 mm. long; calyx tube obconic, 3.5 mm. long, 1.5–2.0 mm. broad at the orifice; calyx lobes about 2.5 mm. long, 1.75 mm. broad; antisepalous stamens inserted about an anther's length above the orifice, the alternisepalous inserted at the orifice, subexserted, the anthers oblong, 0.75 mm. long, 0.5 mm. broad, sessile or subsessile; disc subcupuliform, basally adnate, about 0.5 mm. tall, irregularly lobed, glabrous; pistillode obovoid or tenpin-shaped, 1.0–2.5 mm. long, minutely hirsute at the apex. Pistillate flowers and fruit not seen.

Flowers from February to March.

ECUADOR: GUAYAS: Balao, *Eggers 14316* [(♂) A, M, US]. MANABÍ: El Recreo, *Eggers 14316*bis [F (♂)].

Known as *sapan de venado.*

Eggers 14316 may be a split collection or a label was somehow miscopied.

22g. DAPHNOPSIS AMERICANA ssp. **caribaea** (Griseb.) Nevl. comb. & stat. nov.

Daphnopsis tinifolia (Sw.) Meissn. in DC. Prod. 14:523. 1857, in part.
Daphnopsis caribaea Griseb. Fl. Brit. W. Ind. 278. 1860. [T.: *Imray 118* (♀)!]
Daphnopsis seibertii Standl. in Ann. Mo. Bot. Gard. 24:192. 1937. [T.: *Seibert 444* (♀)!]

Leaf blades lanceolate to elliptic or oblanceolate, rarely obovate, 5–21 cm. long, 1.5–7.0 cm. broad, acute to subcaudate-acuminate at the apex; petiole 5–10 mm. long. Inflorescence 1–9 times dichotomous. Staminate inflorescence umbelliform, the primary peduncle 4–24 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 0.5 mm. long. Staminate flowers: 10–75 per inflorescence; pedicel 1.5–3.5 mm. long; calyx tube obconic, 3.0–4.5 mm. long, 1.0–1.5 mm. broad at the orifice; calyx lobes 1.0–2.5 mm. long, 1.5–2.0 mm. broad; antisepalous stamens inserted about an anther's length above the orifice, the alternisepalous inserted at the orifice, subexserted, the anthers suborbicular to oblong, 0.75–1.0 mm. long, 0.5–0.75 mm. broad, sessile; disc annular, free almost to the base, about 0.25 mm. tall, glabrous, irregularly short-lobed; pistillode tenpin-shaped, 1.0–1.5 mm. long, glabrous. Pistillate inflorescence umbelliform, the primary peduncle 3–10 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 1 mm. long. Pistillate flowers: 10–25 per inflorescence; pedicel 1–3 mm. long; calyx tube suburceolate, 1.5–2.0 mm. long, 1.0–1.5 mm. broad at the orifice; calyx lobes about 1.5 mm.

long, 1 mm. broad; staminodia 8, papilliform; disc as in staminate flower; pistil 1.5–2.0 mm. long, the stigma exserted. Drupe ovoid, 6–7 mm. long, 3–4 mm. in diameter.

ANTIGUA: Sugar Loaf, *Wullschlaegel 494* [M (♀)]; Dunning Valley, *Box 1036* [(♂) F, MO, US]; Wallings, *Box 1104* [(♂) A, US], *1105* [US (♀)]; Boggy Peak, *Rose, Fitch & Russell 3426* [(♀) NY, US]; without precise locality, *Wullschlaegel s. n.* [NY (♂ ♀)].

COLOMBIA: MAGDALENA: Don Amo, Santa Marta, *Smith 2414* [(♂) A, F, GH, K, MO, NY, P, S, U, US], *2416* [(♀) A, F, GH, K, MO, P, S, U, US]; Cuaco Mountain, *Smith 2415* [(♀) A, F, GH, MO, NY, P, S, US]. SANTANDER: Río Suratá Valley, between Bucaramanga and El Jaboncillo, *Killip & Smith 16383* [(♂) A, GH, NY, US]. VALLE: Restrepo, *Killip 11259* [NY (♀)]; Río Dagua, *André 1624* [(♂) F, NY]. WITHOUT PRECISE LOCALITY: *André 1398* [K (♀)], *s. n.* [K (♀)].

COSTA RICA: ALAJUELA: La Palma de San Ramón, *Brenes 5579* [F (♀)], *6775* [F (♂)], *6808* [F (♂)], *6826* [MO (♂)]; La Brisa de Zarcero, Alfaro Ruiz, *Smith H968* [(♂) A, F, US]; La Plama El Socorro de San Ramón, *Brenes 6211* [F (?)]; San Pedro, circa de San Francisco de San Ramón, *Brenes 6680* [(♂) F, NY]. CARTAGO: partially forested pasture lands near Congreja, former cloud forest area, Cordillera de Talamanca, *Williams 16341* [F (♀)]. HEREDIA: Cerro de Zurqui, n.e. of San Isidro, *Standley & Valerio 50263* [(♂) F, US].

DOMINICA: Carib trail from Salybia to Hatton Garden, *Hodge 466* [(♂) MO, US]; rainforest on the precipitous slopes of Morne Colla Anglais, Sylvania, *Hodge 465* [(♂) GH, US]; Sylvania Estate, *Hodge 464* [(♀) GH, NY]; moist forests along Carib trail from Salybia to Concorde Valley (Roseau Track), Carib Reserve, *Hodge & Hodge 3274* [GH (♂)]; Laudat, *Lloyd 353* [NY (♀)]; Humpstead, *Lloyd 666* [NY (♀)]; Chattanooga Estate, *Hodge 885* [NY (?)]; So. Chiltern, *Hodge & Hodge 1534* [(♂) GH, NY]; without precise locality, *Eggers 917* [(♂) M, P, W], *Imray s. n.* [GH (♀)], *118* [K (?), NY (♀)].

GUADELOUPE: BASSE-TERRE: Vieux-fort, *Stehlé 1574* [US (♂)], *Questel 2381* [US (♀)], *2382* [US (♀)]; St. Rose, *Questel 868* [US (♀)]; Gourbeyre, *Duss 2220* [NY (♀)]; without precise locality, *Duss s. n.* [S (♀)], *Krauss s. n.* [NY (♀)], *Liebmann s. n.* [C (♀)], *Rohr s. n.* [C (♂)], *Stehlé 2* [NY (♀)].

MARTINIQUE: Route de Fonds St. Denis à St. Pierre, *Stehlé 2189* [IAN (♂), NY (♂ ♀), US (♂)]; Hateur du Grand Fond, *Hahn 1141* [GH (♀), NY (♀), US (?)]; Rivière Madame, *Stehlé 6029* [A (♂)]; Rivière Pilote, *Hahn 865* [(♀) P, U]; Parnasse, *Duss 2103 & 4567* [NY (♀), US (♂)]; Balata, *Mouret 249* [P (♂)]; without precise locality, *Plee s. n.* [P (♀)], *Duss 2103* [F (♀), GH (♂), MO (♂)], *Hahn 520* [P (♂)], *Richard s. n.* [P (♂ ♀)], *Sieber s. n.* [(♂) C, M, MO, NY, P, U, W].

NICARAGUA: CHONTALES: vicinity of La Libertad, *Standley 8824* [(♂) F, US]. JINOTEGA: Cerro Sialci, sierra s.w. of Jinotega, chiefly in dense wet mixed cloud forest, *Standley 10552* [F (s)]; vicinity of Jinotega, *Standley 9636* [F (s)], *10035* [F (♂)]; along trail between Jinotega and Las Mesitas, w. of Jinotega, *Standley 9809* [F (♀), MO (?)].

PANAMA: COCLÉ: between Las Margaritas and El Valle, *Woodson, Allen & Seibert 1281* [(♂) A, F, MO, NY], *1764* [(♂) A, F, MO, NY]; El Valle de Antón and vicinity, *Seibert 416* [(♂) A, F, MO, NY], *444* [F (♀), MO(♂ ♀), NY (♀)]. HERRERA: Pesé, *Allen 795* [(♀) F, GH, MO, NY, US].

PUERTO RICO: GUAYAMA: Cayey, *Sintenis 2305* [(♀) GH, M, P, S, US], *2360* [(♀) MO, P, US]; Aibonito, *Sintenis 2142* [(♂) GH, M, P, S, US], *Britton, Britton & Brown 5879* [NY (♂)], *Heller & Heller 887* [(♂) F, NY, US], *Wetmore 211* [US (♀)]; road from Insular road to PRRA farm at Guavate, Cayey, *Gregory 82* [NY (♀)]. HUMACAO: Sierra de Juncos, Guvuy, *Sintenis 2635* [(♂) F, NY, US W]; Maunabo, *Britton & Britton 8760* [NY (♀)]; Maunabo to Punta de la Tuna, *Sintenis 5090* [C (♀), U (?)]; along road e. of Ciénega Alta Camp, Western Luquillo Mts., *Holdridge 236* [(♂) A, NY]; Ceiba, *Britton & Britton 7810* [NY (?)], *Britton & Shafer 1533* [(♀) NY, US]. SAN JUAN: Río Piedras, *Johnston 675* [(♂) NY, US]. WITHOUT PRECISE LOCALITY: *Britton & Boynton 8171* [NY (♂)], *Stahl s. n.* [S (♂)].

ST. CROIX: Parasol Hill, *Ricksecker 464* [F (♂)].

ST. EUSTATIUS: White Wall, *Boldingh 1177* [(♂) NY, US] *Stoffers 4044* [U (♀)]; Top of the Quill, *Boldingh 197* [U (s)], *291* [U (s)], *397* [U (?)], *Stoffers 3906* [U (s)].

ST. JOHN: Rosenberg, *Britton & Shafer 312* [C (♀), F (♂), NY (♂ ♀), US (♀)].

ST. KITTS: Buckley Estate, *Britton & Cowell 193* [(♀) NY, US]; without precise locality, *Ryan s. n.* [C (s)].

ST. LUCIA: The Morne, Castries, *P. Beard 1020* [GH (?), MO (?), S (♀), US (?)].

ST. MARTIN: Cul de Sac, *Boldingh 2604* [U (♂)]; Mount Paradis, *Boldingh 3240* [U (?)]; Milldrum hill, *Boldingh 3119* [U (s)], *3124* [U (?)].

ST. THOMAS: Signal hill, *Eggers s. n.* [(♂) C, W]; Mafolie, *Eggers 40* [(♂) M, P, W]; Frenchman's Bay, *Eggers 136* [C (♂), F (♂), M (♀), NY (♂)], *s. n.* [(♂) C, W]; Bolongo, *Eggers 726* [(♀) A, P]; St. Peter, *Britton & Marble 1245* [(♀) C, F, MO, NY, US]; without precise locality, *Eggers s. n.* [NY (♀)], *Raunkiaer s. n.* [C (?)].

ST. VINCENTS: Caley, *Banks s. n.* [W (♂)]; without precise locality, *Guilding s. n.* [K (♂)], *Smith & Smith 927* [GH (♂), NY (♂ ♀)].

SABA: Hellsgate, *Boldingh 1699* [U (♂)] *Stoffers 4139* [U (♂)]; Springbaygut, *Boldingh 2077* [U (s)]; Great Hill, *Boldingh 1386* [U (?)]; Tentgut Hill, *Boldingh 1654* [U (?)]; along road between Bottom and Windwardside, *Boldingh 1359* [U (?)]; Leuvel by Bottom, *Fr. Arnoldo 920* [U (♀)]; Weg Windwardside, *Fr. Arnoldo 920* [U (♂)]; Castle Hill, *Stoffers 4198* [U (s)]; Booby Hill, *Stoffers 4277* [U (♂)], *4305* [U (♂)], *4336* [U (♂)].

TOBAGO: Frenchfield, *Eggers 5542* [A (♀), P (♂), US (♀)]; Logwood Park, *Broadway 3413* [(♂) BY, F, M, NY, S, U]; slopes of French Hill, *Sandwith 1690* [(♂) NY, U]; near Mount Grace, *Broadway 2927* [(♂) MO, P]; ascent of Pigeon Hill, *Sandwith 1813* [NY (♀)].

VENEZUELA: ARAGUA: in transition belt, Guamitas, National Park, *Williams 10246* [(♂) A, F, MICH, MO]. BOLÍVAR: Margarita Island, Juan Diego Trail, *Johnston 257* [(♀) C, F, GH, NY, S, US, W]. FALCÓN: Santa Ana Paraguaná, *Tamayo 846* [US (♂)].

VIEQUES: Cerro Encanta, *Shafer 2550* [(♀) NY, S]; Cerro Ventana, *Shafer 2977* [(?) NY, US].

Beard also reports this group on Montserrat, Nevis, Grenada and the Grenadines but I have not seen any specimens from these islands.

Common names: St. Thomas—*maho*; Guadeloupe—*mahot-piment*; Dominica—*mahout pimente*; St. Vincent—*mahoe pimente*; Tobago—*burn nose*; Costa Rica—*mastate*; Nicaragua—*mancuno, mancume, pellejo de vieja.* The bark is used for rope, particularly for bridles as it is apparently bitter so that the animals will not chew it. Broadway reports that the fruits are eaten by the "blue pigeon".

I have chosen *Imray 118* (NY) as the lectotype for this subspecies.

As previously mentioned, the Puerto Rican specimens show definite affinities to this subspecies. The fact that the specimens are unknown from western Puerto Rico suggests that the plants of Puerto Rico have immigrated from the Lesser Antilles and are not remnants of a group previously existing on the island when it was continuous with the remainder of the Greater Antilles. The differences between specimens of Puerto Rico and the remainder of the Greater Antilles is in some aspects rather striking. The characteristics of the Cuban, Jamaican and Haitian specimens have already been summarized in the description of subspecies *tinifolia.* It may be worth while to describe briefly some of the points on which the Puerto Rican specimens differ. Staminate flowers: pedicel 3.0–3.5 mm. long

and always shorter than the calyx tube; disc 0.25–0.5 mm. tall, adnate only at the extreme base, irregularly short-lobed, glabrous. Pistillate flowers: pedicel 1.0–2.5 mm. long; flower not seen; fruit 6–7 mm. long, 4–5 mm. in diameter. The staminate disc differences and the fruit size are considered to be important differences between these two subspecies at the closest approach to one another.

23. DAPHNOPSIS FLAVIDA Lundell, in Phytologia 2:3. 1941. [T.: *Matuda 4157* (♂)!]

Shrubs or trees to 5 m. tall, the young branches tomentose and glabrescent. Leaf blades elliptic, 3–10 cm. long, 1–4 cm. broad, acute to subcaudate-acuminate at the apex, acute at the base, chartaceous, glabrous above and below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 3–5 mm. long. Inflorescence borne from

Fig. 28. *Daphnopsis flavida*

the young leafy stem or on axillary brachyblasts, umbelliform, minutely sericeous, the primary peduncle 1–5 cm. long, the rhachis about 1 mm. long, the secondary peduncles to 1 mm. long. Staminate flowers: 4–6 per inflorescence; pedicel about 0.5 cm. long; calyx tube narrowly obconic, about 9 mm. long, 1.5–2.0 mm. broad at the orifice, minutely puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, 1.5–2.0 mm. long, 1.0–1.5 mm. broad; petals absent; antisepalous stamens inserted below the orifice, included, the alternisepalous inserted about two anthers' lengths below the antisepalous, included, the anthers oblong, 1.0–1.5 mm. long, 0.5 mm. broad, sessile; disc cupuliform, free, to 1.5 mm. tall, long-lobed, glabrous; pistillode lageniform, about 3 mm. long, glabrous. Pistillate flowers and fruit not seen.

MEXICO: CHIAPAS: Mt. Ovando, Escuintla, *Matuda 4157* [(♂) A, F, GH, MICH, US].

Fig. 29. ***Daphnopsis macrocarpa***

24. DAPHNOPSIS **macrocarpa** Nevl. spec. nov.

Frutices ad 3 m. altae. Folia oblanceolata usque elliptica 11–26 cm. longa 4.0–9.5 cm. lata apice acuminato-attenuata basi cuneata subcoriacea glabra, venis primariis lateralibus arco-ascendentibus; petiolo 0.8–1.3 cm. longo. Inflorescentia mascula umbelliformis; pedunculo primario ca. 7 mm. longo; rhachide ca. 1 mm. longo; pedunculis secundariis 0.5 mm. longis. Flores masculi 3–5 per inflorescentia; pedicello 0.5–1.0 mm. longo; calyce obconico ca. 10.5 mm. longo 1.5 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus pubescentibus 1.5 mm. longis 1 mm. latis; petalis 0; staminibus in planis 2, antheris oblongis 1.0–1.25 mm. longis 0.5 mm. latis sessilibus; disco campanulato glabro; pistillodio ampulliformi apice quamquam dilatato ca. 1.5 mm. longo hirtello. Flores feminei non vidi. Fructus ellipticus ca. 3 cm. longus 1 cm. latus. HOLOTYPUS: *Beard 479* (MO).

Found at altitudes from 300 to 900 meters, flowering in November.

ST. LUCIA: Piton Flore, *Beard 497* [(♀) A, K, MO, NY, U]; Morne Paix Bouch, *Box 1918* [B (♂)].

Known as *mahout piment grand bois* according to Beard.

25. DAPHNOPSIS **alainii** Nevl. spec. nov.

Frutices nisi arbores; ramis juvenibus pubescentibus et glabrescentibus. Folia obovata usque oblanceolata 3–6 cm. longa 1.5–2.5 cm. lata apice acuta usque sub-

Fig. 30. *Daphnopsis alainii*

rotundata basi cuneata coriacea supra glabra subtus puberulentia et glabrescentia, venis primariis lateralibus arco-ascendentibus; petiolo 2–4 mm. longo. Inflorescentia feminea umbelliformis; pedunculo primario 5–10 mm. longo; rhachide ca. 0.5 mm. longo; pedunculis secundariis ca. 0.5 mm. longis. Flores feminei 5–7 per inflorescentia; pedicello 1–2 mm. longo; calyce urceolato 2.0–2.5 longo 1.0–1.5 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus glabris ca. 1.25 mm. longis 1.5 mm. latis; petalis 0; staminodiis 8 papilliformibus; disco humili libero glabro; pistillo 2.5–3.0 mm. longo ovario ovato glabro stigmate capitato exserto. Flores masculi et fructus non vidi. HOLOTYPUS: *Bro. Alain 6464* (MO).

This species is known only from a single collection at an altitude of 950 meters. Flowering in July.

CUBA: LAS VILLAS: Near Pico Potrerillo, Trinidad Mts., *Bro. Alain 6464* [(♀) MO, LS.]

The holotype was part of a gracious gift to the Missouri Botanical Garden from the Colegio de la Salle. Bro. Alain believed that the specimen might possibly represent a hybrid, perhaps between *D. punctulata* and some undetermined species of *Daphnopsis*. The mature leaves resemble the leaves of *D. punctulata* to a certain degree but the resemblance ceases there. This specimen represents a new and quite distinct species.

26. DAPHNOPSIS PAVONII Meissn. in DC. Prod. 14:522. 1857. [T.: *Ruiz & Pavon 134* (♂)!]

Shrubs if not trees, the young branches ochraceous-tomentose. Leaf blades broadly elliptic to obovate, 2–8 cm. long, 1.5–3.5 cm. broad, rotund to subacute at the apex, cuneate to obtuse at the base, subcoriaceous, tomentose and glabrescent above, tomentose below, the costa immersed above, emersed below, the primary lateral veins prominulous above and below, arcuate-ascending; petiole 2–4 mm. long. Inflorescence borne from the young leafy stems, dense racemiform to umbelliform, ochraceous-tomentose, the primary peduncle 3.0–3.5 cm. long, the rhachis to 3 mm. long, the secondary peduncles 1–2 mm. long. Staminate flowers seen only in bud: 12–15 per inflorescence; pedicel to 3.5 mm. long; calyx tube narrowly obconic, about 5 mm. long, 1–2 mm. broad at the orifice, tomentose without, glabrous within; calyx lobes unequal, indefinitely papillate within, the outer about 2 mm. long, 1.5 mm. broad, the inner 1.0–1.5 mm. long and broad; petals absent; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted two anthers' lengths below the orifice, included, the anthers oblong, 0.75–1.0 mm. long, 0.5–0.75 mm. broad, sessile; disc cupuliform, free, about 1 mm. tall, undulate, glabrous; pistillode lageniform, 1.0–1.5 mm. long, glabrous. Pistillate flowers and fruit not seen.

PERU: JUNIN: Palca, *Ruiz & Pavon 134* [(♂) F, P, NY]. WITHOUT PRECISE LOCALITY: *Ruiz & Pavon s. n.* [P (♂)], *Rivero 808* [P (♂)].

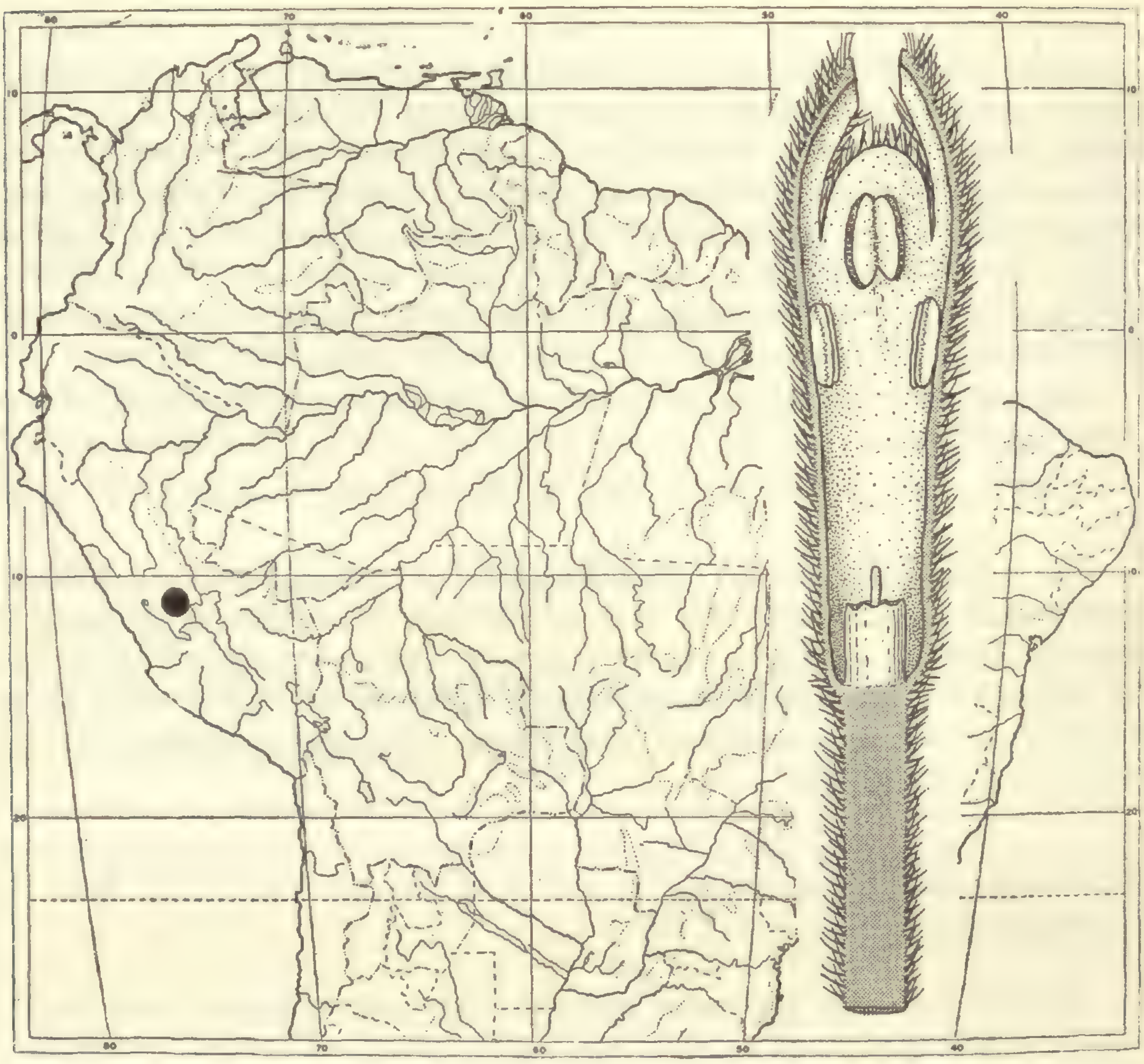

Fig. 31. *Daphnopsis pavonii*

27. DAPHNOPSIS PSEUDOSALIX Domke, in Notizbl. 12:724. 1935. [T.: *Pabst 546* (♂)]

Small shrubs, the young branches densely puberulent and glabrescent. Leaf blades narrowly elliptic, 4.0–12.5 cm. long, 1–2 cm. broad, acuminate or sometimes more or less obtuse at the apex, cuneate at the base, chartaceous, sericeous and glabrescent above, sericeous or strigillose below, the costa plane above, emersed below, the primary lateral veins prominulous on both surfaces, arcuate-ascending, the margin somewhat revolute; petiole 1–6 mm. long. Inflorescences borne from the young leafy stem, racemiform, minutely puberulent, the primary peduncle 1.0–1.8 cm. long, the rhachis 1–6 mm. long, the secondary peduncles 1–3 mm. long. Staminate flowers: (7–)10–15 per inflorescence; pedicel about 2 mm. long; calyx tube narrowly campanulate, about 2 mm. long, 1.0–1.5 mm. broad at the orifice, tomentellose without, glabrous within; calyx lobes unequal, puberulent within, the outer about 1.5 mm. long, 1 mm. broad, the inner 1.0–1.25 mm. long, 1 mm.

broad; petals absent; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted just below the orifice, included, the anthers suborbicular, 0.5 mm. long and broad, sessile; disc annular, free, less than 0.25 mm. tall, more or less entire, glabrous; pistillode bottle-shaped, about 0.75 mm. long, glabrous. Pistillate flowers and fruit not seen.

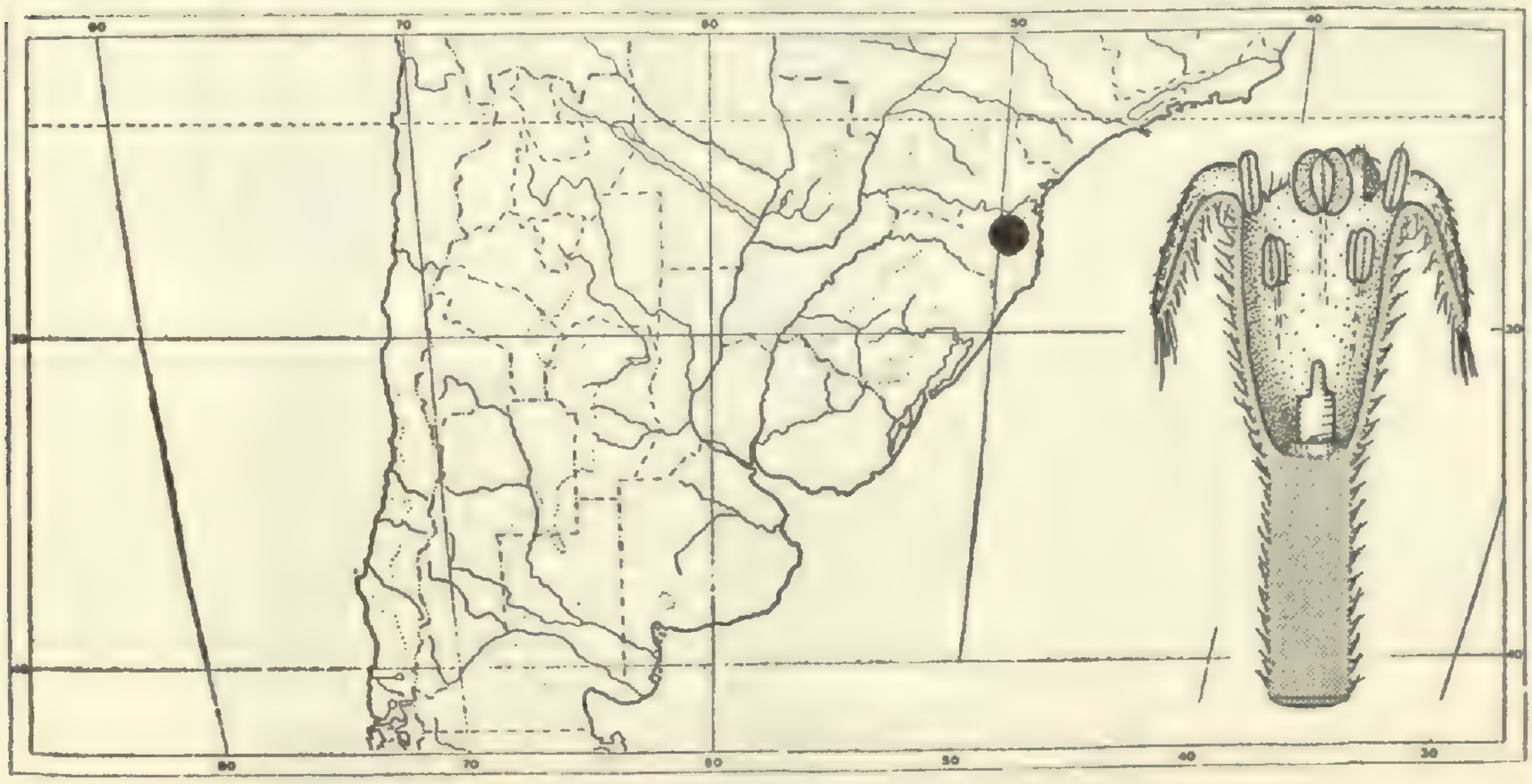

Fig. 32. *Daphnopsis pseudosalix*

BRASIL: SANTA CATARINA: propre Blumenau, *Schwacke & Müller 5981* [RB (♂)]; without precise locality, *Saint Hilaire 1749* [P (♂)], *Nadeaud s. n.* [(♂) F, P].

A poorly known species represented only in older collections.

28. DAPHNOPSIS **anomala** (HBK.) Nevl. comb. nov.

Daphne anomala HBK. Nov. Gen. 2:151. 1817. [T.: *Humboldt & Bonpland 2110* (♀) photo !]
Ovidia humboldti Meissn. in DC. Prod. 14:525. 1857, (based on *Daphne anomala* HBK.)
Ovidia anomala (HBK.) Gilg, in Engl. & Prantl Pflanzenf. 3[6a]:239. 1894

Trees, the young branches strigose and glabrescent. Leaf blades elliptic to oblanceolate, 10–30 cm. long, 3–9 cm. broad, acute to subcaudate-acuminate at the apex, cuneate to subobtuse at the base, chartaceous, densely to sparsely strigose above and below, the costa emersed above and below, the primary lateral veins prominent above and below, arcuate-ascending; petiole 3–10 mm. long. Inflorescences borne from the young leafy stems, umbelliform, strigose, the primary peduncle 3.0–3.5 cm. long, the rhachis 2–3 mm. long, the secondary peduncles about 1 mm. long. Staminate flowers: 20–30 per inflorescence; pedicel about 3 mm. long; calyx tube narrowly obconic, 5–6 mm. long, 1.5–2.0 mm. broad at the orifice, strigose without, glabrous within; calyx lobes unequal, minutely puberulent within, the outer about 1.5 mm. long, 1.0–1.25 mm. broad, the inner about 1.5 mm. long, 1.5–2.0 mm. broad; petals absent; antisepalous stamens inserted just

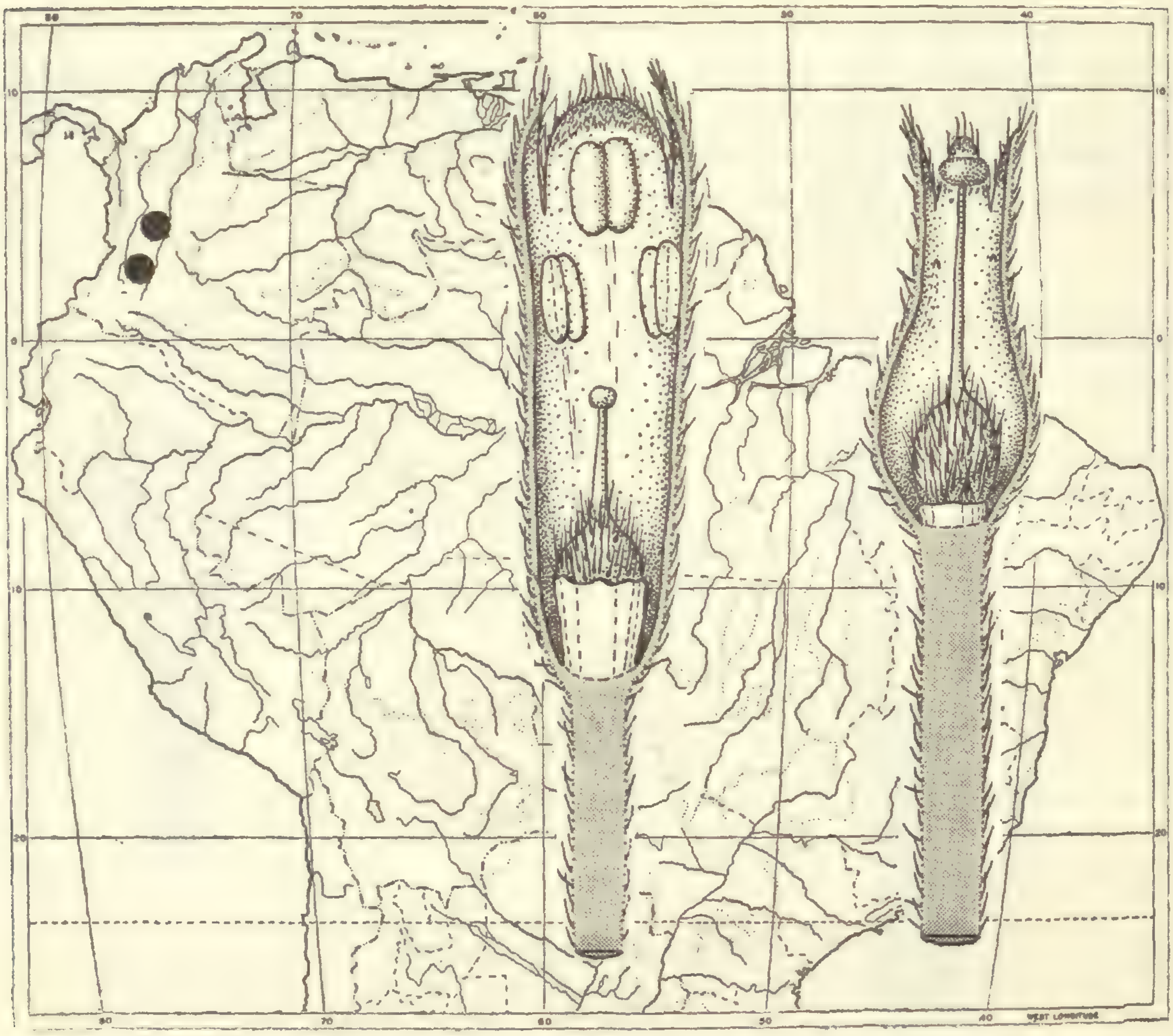

Fig. 33. *Daphnopsis anomala*

above the orifice, subexserted, the alternisepalous inserted about one and a half anthers' lengths below the orifice, included, the anthers suborbicular, 0.75–1.0 mm. long and broad, sessile; disc cupuliform, free, about 1 mm. tall, undulate; pistillode lageniform, about 3 mm. long, densely setose. Pistillate flowers: 12–25 per inflorescence; pedicel about 4.5 mm. long; calyx tube urceolate, about 3.5 mm. long, 1.0–1.5 mm. broad at the orifice, strigose without, glabrous within; calyx lobes subequal, minutely puberulent within, 1.0–1.5 mm. long and broad; petals absent; staminodia 8, papilliform; disc annular, free, about 0.25 mm. tall, undulate to entire, glabrous; pistil about 4 mm. long, the ovary ovoid, densely setose, the style about 2.5 mm. long, the stigma capitate, exserted. Fruit not seen.

COLOMBIA: CAUCA: around Popayan, *Humboldt & Bonpland 2110* [photo F, MO]. TOLIMA: Quindio *Goudot 129* [P (♂ ♀)].

29. DAPHNOPSIS RADIATA Donn. Sm. in Bot. Gaz. 14:30. 1889. [T.: *Von Türckheim 1163* (♀)!]

Shrubs 1.5–2.0 m. tall, the young branches puberulent and glabrescent. Leaf blades elliptic to oblanceolate, 15–25 cm. long, 3–7 cm. broad, obtusely acuminate at the apex, attenuate at the base, subcoriaceous, sericeous and glabrescent above and below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 5–7 mm. long. Inflorescences from the young leafy stems, umbelliform, hirtellous. Staminate inflorescence with the primary peduncle about 3 cm. long, the rhachis 1–2 mm. long, the secondary peduncles 5–13 mm. long. Staminate flowers: 40–60 per inflorescence; pedicel obsolete; calyx tube more or less tubular, about 6.5 mm. long, 1.5 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, 1.5–2.0 mm. long, 1 mm. broad; petals absent; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted about an anther's length below the orifice, included, the anthers oblong, about 1 mm. long, 0.5 mm. broad, sessile; disc tubular, about 1.5 mm. tall, undulate, glabrous; pistillode tenpin-shaped, on a gynophore, about 2.5 mm. long, minutely setose. Pistillate inflorescence with the primary peduncle 2.5–4.0 cm. long, the rhachis

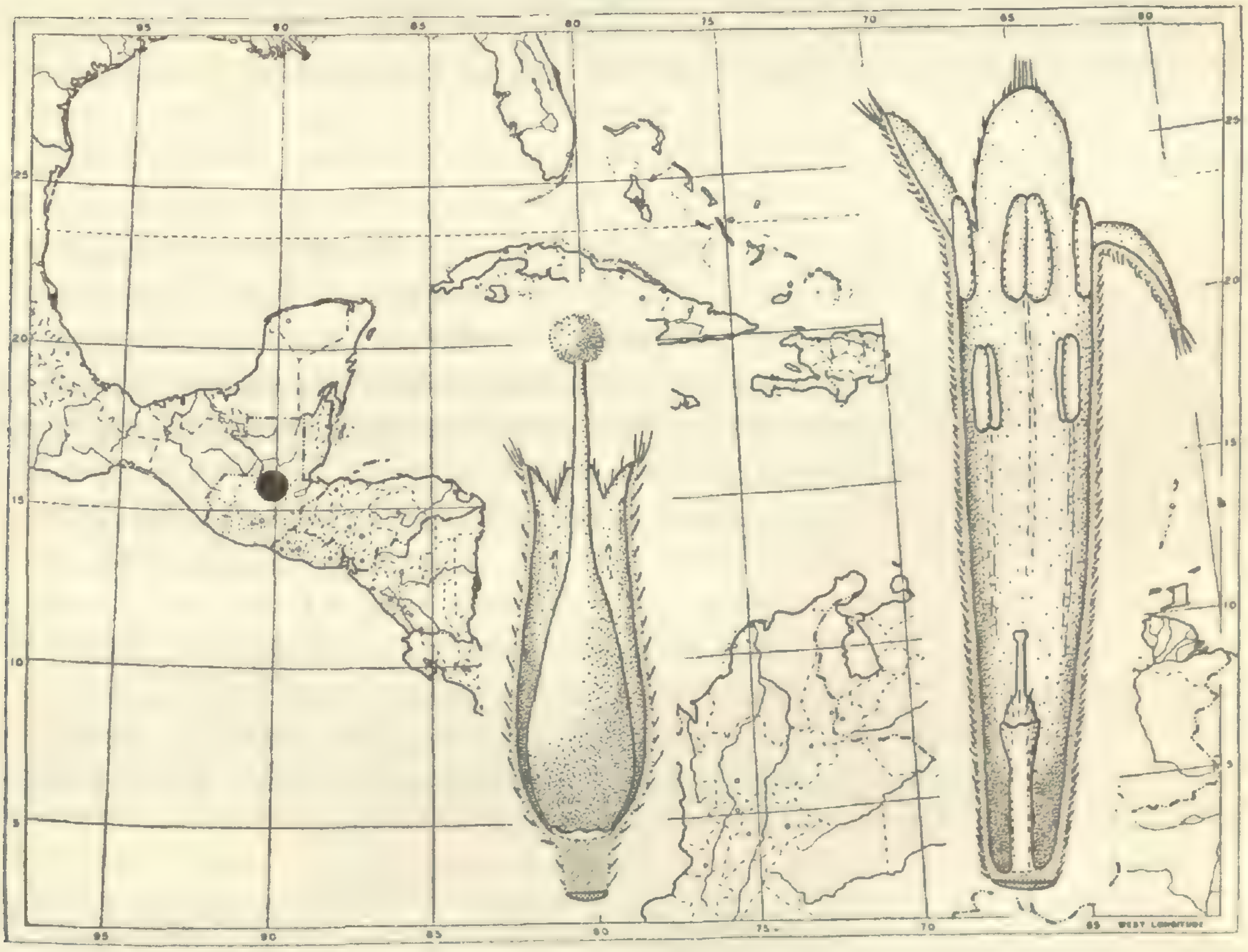

Fig. 34. *Daphnopsis radiata*

about 3 mm. long, the secondary peduncles 2–15 mm. long. Pistillate flowers: 18–32 per inflorescence; pedicel 0.5–1.0 mm. long; calyx tube urceolate, about 3.5 mm. long, 1 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, 0.75–1.0 mm. long, 0.5 mm. broad; petals absent; staminodia 8, papilliform; disc annular, free, undulate, glabrous; pistil about 5.5 mm. long, the ovary ovoid, glabrous, the style about 2 mm. long, the stigma capitate, exserted. Drupe ovoid, about 9 mm. long, 6 mm. in diameter, glabrous.

Flowers from December to April at altitudes of 900 to 1700 meters.

GUATEMALA: ALTA VERAPAZ: dense wet limestone forest near Chirreacté, on the Petén highway, *Standley 91876* [F (♂)]; Coban, *Von Türckheim 1163* [US (♀)], *II 1874* [(♀) NY, US]; Finca Sepacuite, *Cook & Griggs 511* [US (♀)]; Finca Mocca, Suchitepéquez, *H. Johnson 103* [US (♀)].

This species appears to be related to the following two species, *D. tuerckheimiana* and *D. selerorum*, on the basis of floral morphology.

The *Von Türckheim* collection *II 1874* is a mixed collection. The New York specimen was collected in April 1908 while the U. S. National Herbarium specimen was collected in May of 1907.

30. DAPHNOPSIS TUERCKHEIMIANA Donn. Sm. in Bot. Gaz. 16:13. 1891. [T.: *Von Türckheim 1039* (♀)!]

Small trees, the young branches puberulent or tomentose and glabrescent. Leaf blades more or less elliptic, 7–12 cm. long, 2.0–4.5 cm. broad, acuminate to subcaudate-acuminate at the apex, acute to more or less obtuse at the base, coriaceous, strigose and glabrescent above and below, the costa immersed above, emersed below, the primary lateral veins obscure to prominulous on both surfaces, arcuate-ascending; petiole 2–4 mm. long. Inflorescences borne terminally or on axillary brachyblasts from the young leafy stems, umbelliform, ochraceous-tomentose. Staminate inflorescence with the primary peduncle 0.5–1.0 mm. long, the rhachis to 1 mm. long, the secondary peduncles about 0.5 mm. long. Staminate flowers: 3–7 per inflorescence; pedicel 0.5–2.0 mm. long; calyx tube tubular, 6–8 mm. long, 0.5–0.75 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, 0.75–1.5 mm. long, 0.5–0.75 mm. broad; petals absent; antisepalous stamens inserted just below the orifice, subexserted, the alternisepalous inserted about two anthers' lengths below the antisepalous, included, the anthers oblong, about 0.75 mm. long, 0.5 mm. broad, sessile; disc cupuliform, free, 0.5–0.75 mm. tall, more or less undulate, glabrous; pistillode tenpin-shaped, about 1.5 mm. long, setose. Pistillate inflorescence with the primary peduncle about 7 mm. long, the rhachis 1–2 mm. long, the secondary peduncles 2–5 mm. long. Pistillate flowers: 15–20 per inflorescence; not seen. Drupe ovoid, about 7 mm. long, 4 mm. in diameter, puberulent at the apex.

Flowers in September at altitudes of 2500 to 3800 meters.

GUATEMALA: ALTA VERAPAZ: Pansamalá, *Von Türckheim 1039* [(♂) GH, M, NY, P, US]. ZACAPA: cloud forest in ravine bordering Quebrada Alejandria, summit of Sierra de las Minas, vicinity of Finca Alejandria, *Steyermark 29883* [(♀) F, NY].

Fig. 35. *Daphnopsis tuerckheimiana*

Possibly closely related to the following species and differing from it primarily by inflorescence structure. Unfortunately, I have not seen pistillate flowers so I am unable to determine the closeness of the affinity.

The *Von Türckheim* collection *1039* of the U. S. National Herbarium has mounted on it an abnormal flower. This staminate flower is 5-merous, i.e., 5 calyx lobes and 10 stamens, in addition, three pistillodes are present, two of which appear to share a common gynophore, all three are surrounded by a common disc.

31. DAPHNOPSIS SELERORUM Gilg, in Verhandl. Bot. Ver. Brandenb. 48:153. 1917. [T.: *Seler 2866* (♀)]

Daphnopsis malacophylla Standl. & Steyerm. in Field Mus. Publ. Bot. 23:68. 1944. [T.: *Steyermark 49104* (♀)!]

Shrubs or trees, 2–10 m. tall, the young branches hispid and glabrescent. Leaf blades elliptic, 3–16(–27) cm. long, 2–9 cm. broad, acuminate to subcaudate-attenuate at the apex, more or less cuneate at the base, subcoriaceous, strigose and glabrescent above and below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 3–7 mm. long. Inflorescence borne from the young leafy stems or from axillary brachyblasts, umbelliform, tomentose. Staminate inflorescence with the primary

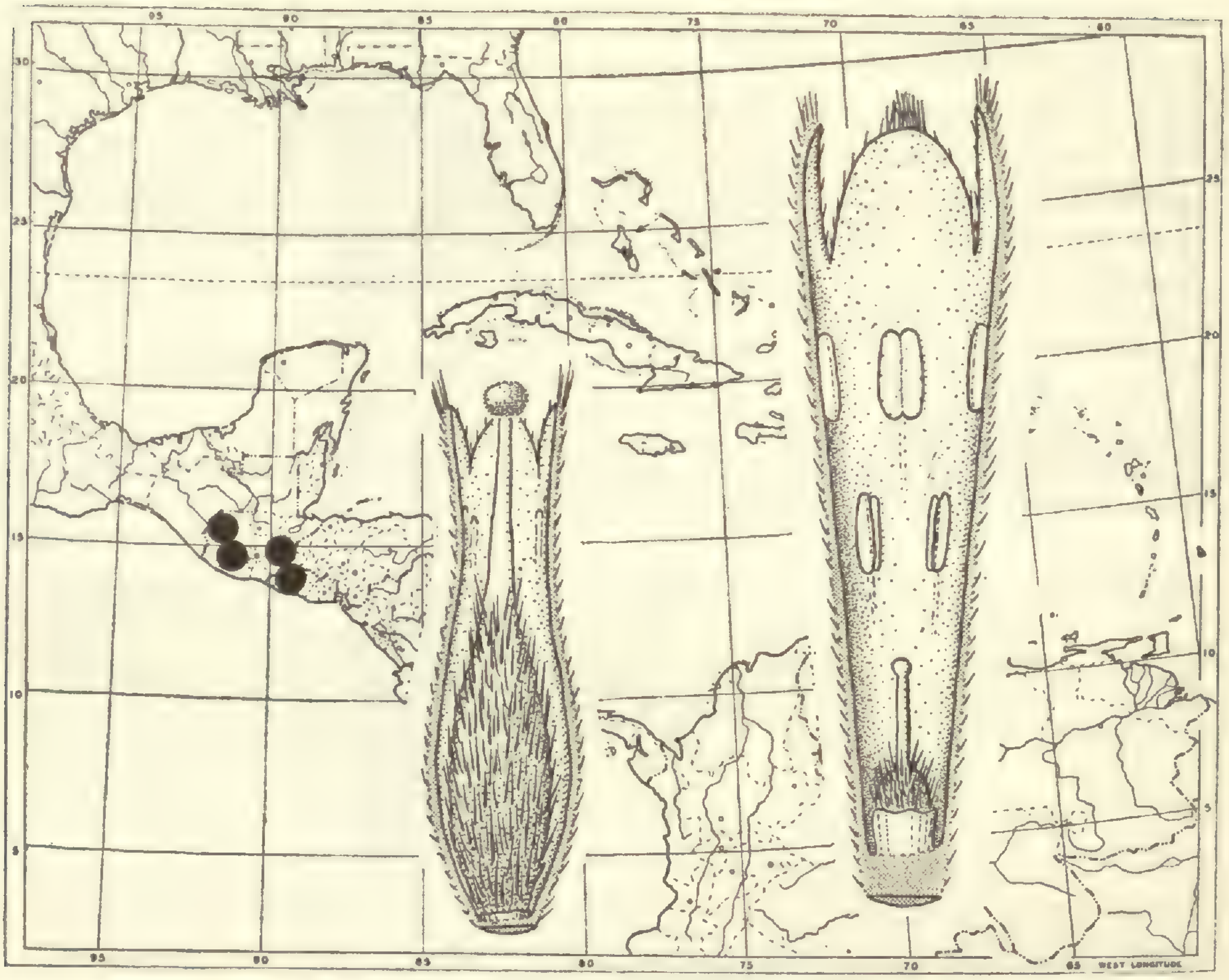

Fig. 36. *Daphnopsis selerorum*

peduncle about 1 cm. long, the rhachis 1–2 mm. long, the secondary peduncles 1–5 mm. long. Staminate flowers: (7–)30–60 per inflorescence; pedicel about 0.5 mm. long; calyx tube narrowly obconic, 6.0–6.5 mm. long, 1.5–2.0 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, 1.5–2.0 mm. long, 1.0–1.5 mm. broad; petals absent; antisepalous stamens inserted at the orifice to about an anther's length below the orifice, subexserted to included, the alternisepalous inserted about two anthers' lengths below the antisepalous, included, the anthers oblong, about 0.75 mm. long, 0.5 mm. broad, sessile; disc cupuliform, free, about 0.5 mm. tall, undulate, glabrous; pistillode lageniform, about 2 mm. long, setose. Pistillate inflorescence with the primary peduncle 1–5 cm. long, the rhachis 1–2 mm. long, the secondary peduncles 2–3(–7) mm. long. Pistillate flowers: 7–20(–70) per inflorescence; pedicel obsolete; calyx tube urceolate, 4.0–4.5 mm. long, 1.0–1.5 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, 1.0–1.5 mm. long, about 1 mm. broad; petals absent; staminodia 8, papilliform; disc annular, free, about 0.25 mm. tall, pubescent; pistil 4.5–5.5 mm. long, the ovary ovoid, hairy, the style about 2.5 mm. long, the stigma capitate, exserted. Drupe ovoid, 7–8 mm. long, 3–5 mm. broad, pubescent, ultramarine to black.

Found at altitudes of 1200 to 3000 meters where it flowers during July and August.

GUATEMALA: CHIQUIMULA: Cerro Tixixí, 3–5 miles n. Jocotán, *Steyermark 31569* [A (♂), F (s)]. HUEHUETENANGO: wet cloud forest at Cruz de Limón, between San Mateo Ixtatán and Nucá, *Steyermark 49820* [F (♂)], *49844* [(♀) F, US]; Cerro Huitz, between Mimanhuitz and Yulhuitz, *Steyermark 48559* [F (♀)], *48646* [US (♀)]; Cerro Cananá, between Nucapuxlac and Cananá, *Steyermark 49104* [(♀) F, US]; vicinity of Maxbal, about 17 mi. n. of Barillas, *Steyermark 48867* [(♂) A, F]; Cerro Victoria, near Barillas, *Steyermark 49743* [(♂) A, F], *49744* [(♀) F, US]. QUETZALTENANGO: between Finca Pirineos and Finca Soledad, lower south-facing slopes of Volcán Santa María, between Santa María de Jesús and Calahuaché, *Steyermark 35526* [F (♀)]; along old road between Finca Pirineos and Patzulín, *Standley 86942* [F (♂)], *86961* [F (♂)], *86988* [F (♂)]; along great barranco between Finca Pirineos and San Juan Patzulín, *Steyermark 33642* [F (♂)]; Finca Pirineos, *Standley 68337* [F (♀)]; near Calahuaché, *Standley 67129* [(?) A, F]; along Quebrada San Gerónimo, Finca Pirineos, *Steyermark 33428* [F (♀)]; Palmar, *Skutch 1422* [F (♂)].

EL SALVADOR: SANTA ANA: Cerro Miramundo, above Hacienda Los Planos, n.e. of Metapán, *Carlson 919* [F (♂)].

According to Steyermark it is known as *palo de chonta*.

This species is rather variable, particularly in leaf shape and size, flower number and overall pubescence. These differences may be due to water availability or altitudinal factors.

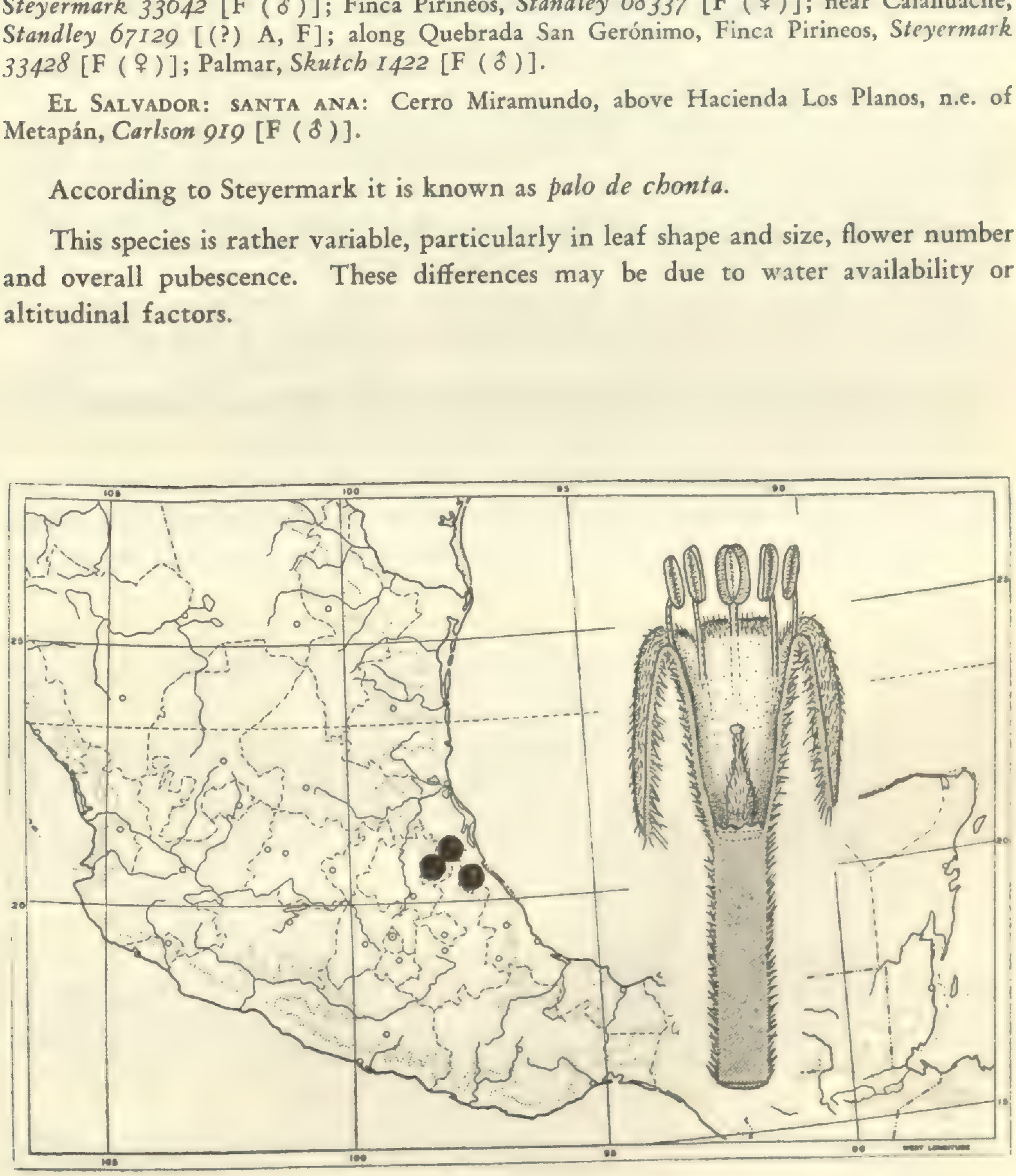

Fig. 37. *Daphnopsis brevifolia*

32. Daphnopsis **brevifolia** Nevl. spec. nov.

Frutices; ramis juvenibus pubescentibus usque glabrescentibus. Folia elliptica usque oblanceolata vel obovata 2.0–6.5 cm. longa 0.7–1.7 cm. lata apice acuta usque acuminata basi cuneata subcoriacea puberulentia usque glabrescentia, venis primariis lateralibus arco-ascendentibus; petiolo 3–4 mm. longo. Inflorescentia umbelliformis; pedunculo primario 2–6 mm. longo. rhachide 3–5 mm. longo; pedunculis secundariis ca. 0.25 mm. longis. Flores masculi 6–10 per inflorescentia; pedicello 3.0–3.5 mm. longo; calyce campanulato 2.0–2.5 mm. longo 1.5 mm. lato extus hispidulo intus glabro; calycis lobis subequalibus intus pubescens ca. 2.5 mm. longis 1.5 latis; petalis 0; staminibus in planis 2, antheris oblongis ca. 0.75 mm. longis 0.5 mm. latis subsessilibus filamentis 0.5–1.0 mm. longis; disco humili adnato glabro; pistillodio ampulliformi apice quamquam dilatato ca. 1.5 mm. longo, pubescente. Flores feminei et fructus non vidi. HOLOTYPUS: *Purpus 6271* (MO).

Flowers in July and August.

Mexico: veracruz: barranca de Zacuapán, *Purpus 4114* [(♂) A, F, MO, US]; Baños del Carrizal, *Purpus 6271* [(♂) A, F, MO, NY, US]; barranca San Martín *Purpus 4114*^{bis} [A (♂)].

Superficially the specimens of this species appear quite similar to those of *D. mollis* but differs from it, primarily, by the lack of petals.

Purpus 4114 is composed of two collections: those collected at barranca de Zacuapán in July of 1907 and those collected at San Martín in July of 1916.

33. Daphnopsis punctulata Urb. Symb. Ant. 9:407. 1925. [T.: *Ekman 14214* (♂)!]

Shrubs, the young branches minutely black-punctate and glabrescent. Leaf blades oblanceolate-acuminate, 2–7 cm. long, 1–3 cm. broad, subcaudate-acuminate at the apex, cuneate at the base, thin-coriaceous, glabrous above and below, the

Fig. 38. *Daphnopsis punctulata*

costa plane above, emersed below, the primary lateral veins prominulous above and below, arcuate-ascending, with a conspicuous submarginal vein; petiole to 3 mm. long. Inflorescence borne from the younger leafy or bracteate stems, umbelliform or dense racemiform, minutely black-punctate, the primary peduncle 1–3 mm. long, the rhachis 0.5–4.0 mm. long, the secondary peduncles to 1 mm. long. Staminate flowers: 3–15 per inflorescence; pedicel about 1.5 mm. long; calyx tube campanulate (?), about 1 mm. long, 0.5 mm. broad at the orifice, glabrous; calyx lobes subequal, indefinitely papillate within, about 1 mm. long, 0.5–0.75 mm. broad; petals absent; antisepalous stamens inserted at the orifice, exserted, the alternisepalous inserted slightly below the orifice, included, the anthers oblong, 0.5–0.75 mm. long, 0.5 mm. broad, sessile; disc basally adnate, only several small lobes, free, glabrous; pistillode tenpin-shaped, about 0.5 mm. long, glabrous. Pistillate flowers and fruit not seen.

Flowers in August, found from 600 to 900 meters.

CUBA: ORIENTE: Pico Turquino, *Bro. León 10804* [MO (s), NY (♂)]; Sierra Maestra, on the water divide between Río Yara and Río Plata, in "monte frio", *Ekman 14214* [(♂)NY, S], *5613* [S (?)].

This poorly known species is easily recognized by the black punctations on young stems and inflorescences.

34. DAPHNOPSIS FICINA Standl. & Steyerm. in Field Mus. Publ. Bot. 22:254. 1940. [T.: *Salas 1442* (♀)!]

Shrubs or small trees 2–5 m. tall, the young branches minutely puberulent and glabrescent. Leaf blades elliptic to oblanceolate, 3–11 cm. long, 1–4 cm. broad, acute to somewhat obtuse at the apex, cuneate at the base, subcoriaceous, sericeous and glabrescent above and below, the costa immersed above, emersed

Fig. 39. *Daphnopsis ficina*

below, the primary lateral veins prominulous above, prominent below, arcuate-ascending, the margin somewhat thickened; petiole 2–3 mm. long. Inflorescences borne from the young leafy stems, umbelliform or rarely subracemiform. Staminate inflorescence with the primary peduncle 0.8–4.0(–6.0) cm. long, the rhachis 1–3 mm. long, the secondary peduncles 2–12 mm. long. Staminate flowers: 6–30 per inflorescence; pedicel obsolete; calyx tube tubular, 2.5–3.5 mm. long, ca. 1 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, puberulent within, about 1 mm. long and broad; petals absent or rarely with the slightest suggestion of an annulus; antisepalous stamens inserted at the orifice, subexserted, the alternisepalous inserted a little below the orifice, included, the anthers suborbicular, about 0.5 mm. long and broad, sessile; disc completely adnate or rarely with the margin free, glabrous; pistillode tenpin-shaped, about 1.5 mm. long, glabrous. Pistillate inflorescence with the primary peduncle 1–3 cm. long, the rhachis 1–3 mm. long, the secondary peduncles 2–6 mm. long. Pistillate flowers: 3–9 per inflorescence; pedicel 0.5 mm. long; calyx tube urceolate or sometimes campanulate, 1.5–2.5 mm. long, 1.0–1.5 mm. broad at the orifice, puberulent without, glabrous within; calyx lobes subequal, minutely puberulent within, 1 mm. long, 0.75–1.0 mm. broad; petals as in staminate flowers; staminodia 8, squamelliform; disc completely adnate; pistil 2–3 mm. long, the ovary ovoid, glabrous, the stigma minutely capitate, exserted. Drupe ovoid, about 11 mm. long, 5 mm. in diameter, black.

Found at altitudes of 1600 to 2500 meters. Flowers from December to May.

GUATEMALA: BAJA VERAPAZ: mountainside n. of Santa Rosa, *Standley 69919* [(♀) F, NY]. GUATEMALA: in forests of Manzanote, La Cieneguilla, San José Pinula, *Salas 653* [US (♂)], *1442* [F (♂)]; cloud forest area, Montaña de las Nubes, about 20 kms. w. of San José Pinula, *Williams & Molina 15270* [(♂) A, US]; without precise locality, *Aguilar 719* [F (?)]. JALAPA: in old clearings in mixed pine cloud forest, Montaña de las Nubes near Soledad, *Williams 14233* [F (♂)]; Potrero Carrillo, at Hierba Buena, 14 mi. n.e. of Jalapa, *Steyermark 33037* [F (♀)]. QUICHÉ: Chichicastenago, *Hunnewell 15197* [A (♂)], *Standley 62417* [(?) F, US], *62428* [(?) A, F]; without precise locality, *Aguilar 778* [F (?)]. SANTA ROSA: Laguna de Ayarza, *Heyde & Lux 4071* [(♀) A, MO, NY, US]. ZACAPA: trail between Santa Rosalía de Mármol and Vegas, *Steyermark 42924* [F (♂)].

MEXICO: CHIAPAS: Letrero, near Siltepec, *Matuda 4338* [(♂) A, F, MO, NY, US]; Saxchanal, in pineland, *Matuda 4298* [(♂) A, F, MO, NY], *17803* [F (♀)].

According to Salas this species is known as *chilillo*.

A majority of the specimens belonging to this species have been misidentified as *D. lindenii*, a name superceded by *D. americana*. The mistake is easily made because of vegetative and inflorescence similarities. The inflorescences of the two species appear to be very similar at first glance but their construction is entirely different. In *D. americana* the flowers are borne on very short secondary peduncles and rather long pedicels, whereas the flowers of *D. ficina* are borne on long secondary peduncles and very short or obsolete pedicels.

This species appears to be variable in some features which are not ordinarily variable in other species. In *Hunnewell 15197* a fairly well delineated faucal annulus is to be found, a condition lacking in other specimens. In *Steyermark 42942* the disc of the staminate flowers, which is usually completely adnate, has

a decidedly free margin. Another collection of interest, *Heyde & Lux 4071*, has flowers in which the calyx tube becomes extremely campanulate.

Subgenus II. NEIVIRA (Griseb.) Nevl. stat. nov.

Section *Neivira* Griseb. Symb. Fl. Argent. 133. 1879. [T.: *D. racemosa* Griseb.]

KEY TO THE SPECIES

a. Calyx tube glabrous or villous within, the lobes puberulent within, the disc of free lobes, annular or cupuliform.
  b. Staminate flowers with the disc of free lobes; pistillate flowers with the disc annular. Plants of Brasil (Minas Gerais, Rio de Janeiro).....35. D. UTILIS
  bb. Staminate and pistillate flowers with the disc cupuliform.
    c. Calyx tube glabrous within; pistillate flowers with 8 or 0 staminodia.
      d. Flowers in dense racemiform inflorescences; pistillate flowers with 8 staminodia.
        e. Staminate flowers not seen; pistillate flowers 5–12 per inflorescence, the calyx lobes 1.0–1.5 mm. long, 0.75–1.25 mm. broad, the disc to 1 mm. tall, the ovary ovoid. Plants of Ecuador.....36. D. ESPINOSAE
        ee. Staminate flowers 5–6 per inflorescence, the antisepalous stamens exserted, the alternisepalous stamens subexserted, the anthers subsessile, the disc deeply and irregularly lobed, the pistillode ovoid, glabrous; pistillate flowers 1–4 per inflorescence, the calyx lobes about 0.75 mm. long, 0.75 mm. broad, the disc to 0.5 mm. tall, the ovary broadly fusiform. Plants of Brasil (Rio de Janeiro).....37. D. ALPESTRIS
      dd. Flowers in lax racemiform inflorescences; pistillate flowers with 0 staminodia. Plants of Brasil (Rio de Janiero).....38. D. SCHWACKEANA
    cc. Calyx tube sparsely to densely villous within.
      f. Flowers in lax racemiform inflorescences; pistillate flowers with 8 staminodia.
        g. Leaves subauriculate to auriculate at the base, thin-coriaceous; staminate flowers 4–17 per inflorescence, the calyx tube tubular, obconic or somewhat campanulate, 1.5–2.0 mm. broad at the orifice, the calyx lobes 1.0–1.5 mm. long, 0.75–1.5 mm. broad, the anthers sessile or on filaments to 0.25 mm. long, the pistillode glabrous or villous; pistillate flowers (1–)3–19 per inflorescence. the pedicel essentially obsolete, the ovary broadly fusiform, glabrous or villous. Plants of Argentina, Brasil (Ceará, Mato Grosso, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul, São Paulo, Sta. Catarina), Paraguay and Uruguay.....39. D. RACEMOSA
        gg. Leaves cuneate at the base, thick-coriaceous; staminate flowers 15–25 per inflorescence, the calyx tube broadly campanulate, about 4 mm. broad at the orifice, the calyx lobes 2.0–2.5 mm. long, 1.5–1.75 mm. broad, the anthers on filaments 0.5–1.0 mm. long, the pistillode villous; pistillate flowers 8–25 per inflorescence, the pedicel about 1.5 mm. long, the ovary ovoid, villous at least towards the apex. Plants of Brasil (Rio de Janeiro).....40. D. CORIACEA
      ff. Flowers in dense racemiform inflorescences; pistillate flowers lacking staminodia.
        h. Leaves 4.5–14.0 cm. long; staminate flowers with the calyx tube obconic, 3–4 mm. long, 1–2 mm. broad at the orifice, hispidulous without, the petals connate into an obscure faucal annulus, the filaments about 0.25 mm. long, the pistillode fusiform, 3.0–4.5 mm. long; pistillate flowers with the calyx tube about 1 mm. long, hispidulous without, glabrous within, the petals connate into an obscure faucal annulus, the ovary ovoid, glabrous or villous at the base. Plants of Brasil (Minas Gerais, Paraná, Rio Grande do Sul, São Paulo) and Uruguay.....41 D. SELLOWIANA
        hh. Leaves 3–30 cm. long; staminate flowers with the calyx tube campanulate, 1.5–3.0 mm. long, 1.5–4.0 mm. broad at the orifice, tomentose without, the petals absent, the filaments 0.25–1.5 mm. long, the pistillode ovoid, 2.0–3.5 mm. long; pistillate flowers with the calyx tube 1.0–1.75 mm. long, tomentose without, glabrous or sparsely villous within, the petals absent, the ovary obovoid, densely villous. Plants of Brasil (Minas Gerais, Paraná, Goias, Rio de Janeiro, Sta. Catarina, São Paulo).....42. D. BETA
aa. Calyx tube villous (sometimes in *D. martii*) or glabrous within, the lobes indefinitely papillate within, the disc cupuliform.
  i. Staminate flowers with the pistillode villous; pistillate flowers with the staminodia 4 or 0.

j. Staminate flowers with the calyx tube about 4.5 mm. long, glabrous within, the petals connate into an obscure faucal annulus, the anthers about 0.25 mm. long and broad, the pistillode obovoid; pistillate flowers with the calyx tube campanulate, glabrous within, the petals absent, the staminodia absent, the ovary glabrous. Plants of Brasil (Bahia and Pernambuco).....43. D. SANCTAE-TERESAE

jj. Staminate flowers with the calyx tube about 1.5 mm. long, glabrous or villous within, the petals absent, the anthers about 0.75 mm. long and broad, the pistillode fusiform; pistillate flowers with the calyx tube urceolate, glabrous or villous within, the petals absent, the staminodia 4, the ovary villous. Plants of Brasil (Rio de Janeiro).....44. D. MARTII

ii. Staminate flowers with the pistillode glabrous; pistillate flowers not seen.

k. Staminate flowers with the pedicel obsolete, the calyx tube obconic, the anthers on filaments about 1.5 mm. long, the pistillode fusiform. Plants of Brasil (Rio de Janeiro).....45. D. GEMMIFLORA

kk. Staminate flowers with the pedicel to 1.5 mm. long, the calyx tube campanulate, the anthers sessile, the pistillode ovoid. Plants of Bolivia.....46. D. BOLIVIANA

35. DAPHNOPSIS UTILIS Warm. in Kjoeb. Vidensk. Meddel 318. 1871. [T.: *Glaziou 2963* (♀)!]

Daphnopsis sessiliflora Griseb. ex Taub. in Engl. Bot. Jahrb. 12, Beibl. 27:8. 1890. [T.: *Glaziou 17747* (♂)!]

Shrubs, if not trees. Leaf blades elliptic to oblanceolate or obovate, 2–8 cm. long, 0.5–1.5 cm. broad, obtuse to acute at the apex, cuneate at the base, thin-coriaceous, glabrous above and below, the costa plane above, emersed below, the primary lateral veins obscure above, prominulous below, arcuate-ascending, the margin revolute; petiole 1–2 mm. long. Inflorescences borne from the young leafy or defoliated nodes, few-flowered, dense subracemiform, the primary peduncle 0.25–1.0 mm. long, the rhachis 0.25–0.5 mm. long, the secondary peduncles 0.25–1.5 mm. long. Staminate flowers: 2–4 per inflorescence; pedicel obsolete; calyx tube campanulate, 1–2 mm. long, 1.0–1.25 mm. broad at the orifice, essentially glabrous without, sparsely to densely villous within; calyx lobes unequal, indefinitely papillate within, the outer to 1.75 mm. long, 0.5–0.75 mm. broad, the inner 1.75 mm. long, 1.0–1.5 mm. broad; petals connate into an extremely obscure faucal annulus; antisepalous stamens inserted just above the orifice to 1 mm. above the orifice, exserted, the alternisepalous inserted just below the orifice, exserted, the filaments 1.0–2.5 mm. long, the anthers orbicular, 0.25–0.5 mm. long and broad;

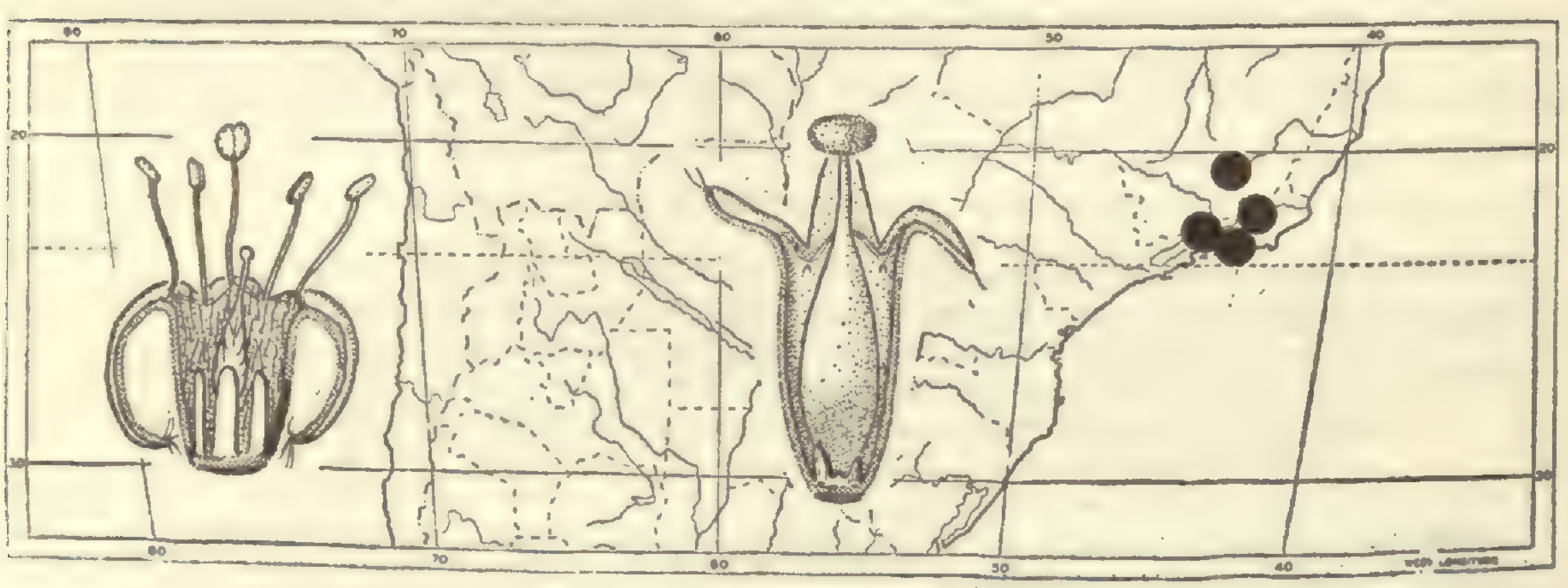

Fig. 40. ***Daphnopsis utilis***

disc of several free lobes, 0.5–1.25 mm. tall, glabrous; pistillode fusiform, borne on a gynophore, 1.75–3.5 mm. long, sparsely to densely villous. Pistillate flowers: 2–5 per inflorescence; pedicel obsolete; calyx tube suburceolate to campanulate, about 2 mm. long, 1 mm. broad at the orifice, glabrous without, glabrous within; calyx lobes subequal, indefinitely papillate within, about 1 mm. long, 0.5 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform; disc annular, free, irregularly lobed, glabrous; pistil to 3 mm. long, the ovary fusiform, glabrous, the style 0.5–1.0 mm. long, the stigma capitate, exserted. Drupe not seen.

Flowers in February and March.

BRASIL: MINAS GERAIS: Lagôa Santa, *Warming 734* [C (♂), NY (?), W (s)]; Itabira do Campo, *Mattos s. n.* [R (♂)]. RIO DE JANEIRO: Alto Macabé, *Glaziou s. n.* [P (♀)], *2963* [C (♀), F (fragment s), RB (♀)]; District Federal, *Ducke s. n.* [MO (♂)]; Serra Carioca, D. Federal, *Barbosa & Fidalgo 3* [RB (♂)], *Occhioni 362* [RB (?)]; Sommet du Morro Queimado, *Glaziou 2963*[bis] [P (♂)]; Serra dos Orgãos, *Glaziou 17747* [(♂) C, F, NY, P, RB, US]; Tijuca, *Schwacke 7322* [RB (♂)], *Glaziou s. n.* [R (?)], *Ule 4382* [R (♀)]; Estr. do Redentor, *Packolt & Freire 480* [R (♂)]; without precise locality, *Glaziou 4070* [C (♀)].

Known as *embira branca.*

In the original description of this species Warming cited *Glaziou 2963* and *4070.* I have chosen *Glaziou 2963* (C) as the lectotype because the location of the *4070* specimen is unknown. It is to be noted that *Glaziou 2963* is a split collection, i.e., the collection from Alto Macabé was made in 1869 and the collection at the Sommet de Morro Queimado was made in 1880.

36. DAPHNOPSIS ESPINOSAE Monachino, in Phytologia 2:212. 1947. [T.: *Espinosa 205* (♀)!]

Shrubs or trees (?), the young branches glabrescent. Leaf blades elliptic to

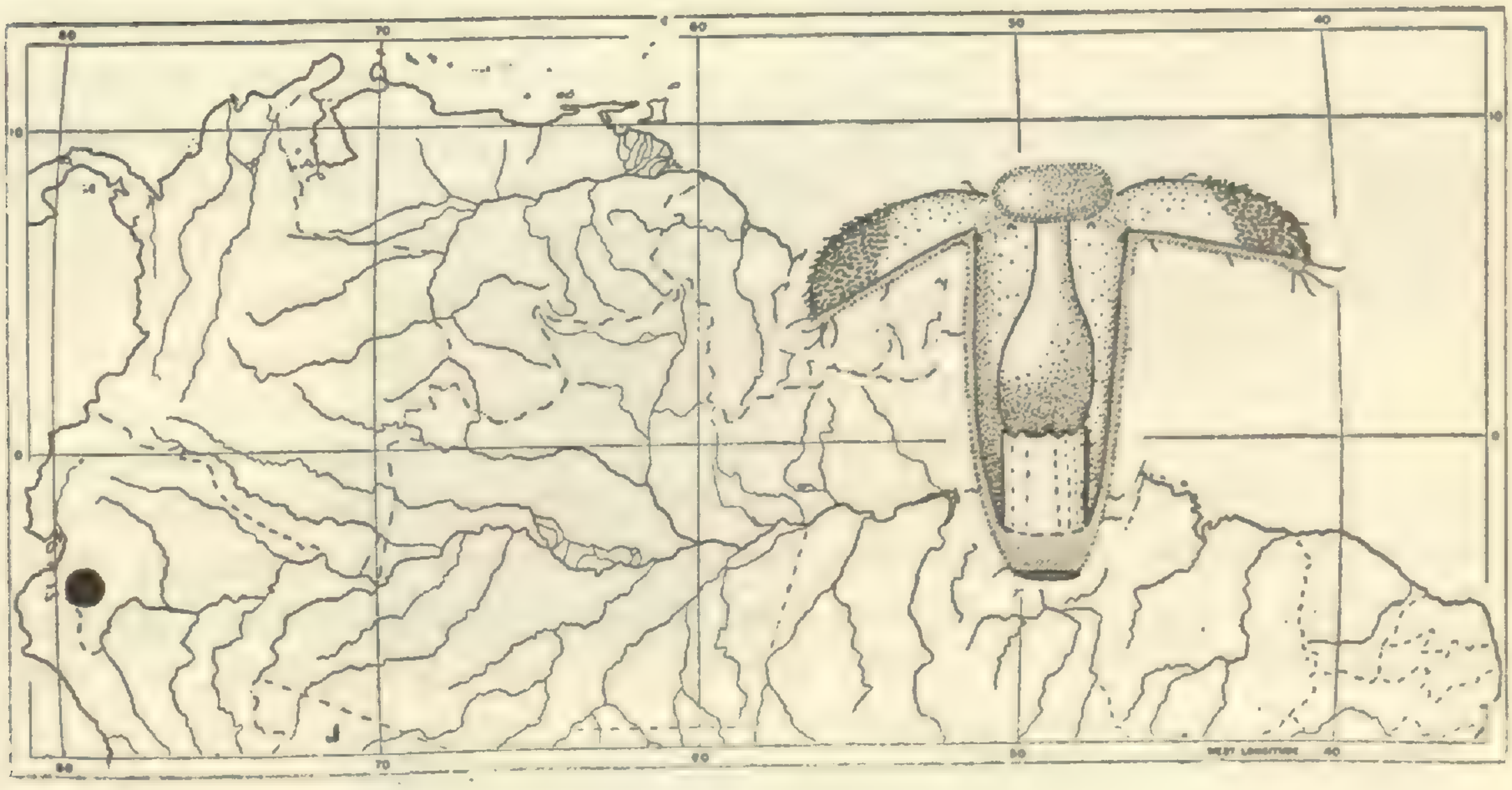

Fig. 41. *Daphnopsis espinosae*

oblanceolate, 3–8 cm. long, 1–3 cm. broad, acute at the apex, broadly cuneate at the base, thin-subcoriaceous, glabrous above and below, the costa plane above, emersed below, the primary lateral veins prominent above and below, arcuate-ascending; petiole 2–4 mm. long. Inflorescences borne from the young leafy or defoliated nodes, dense racemiform, tomentulose, the primary peduncle 3–14 mm. long, the rhachis 0.5–4.0 mm. long, the secondary peduncles 0.5–2.0 mm. long. Staminate flowers not seen. Pistillate flowers: 5–12 per inflorescence; pedicel to 0.5 mm. long; calyx tube campanulate, about 2.5 mm. long, 1.25 mm. broad at the orifice, sparsely puberulent without, glabrous within; calyx lobes subequal, puberulent within, 1.0–1.5 mm. long, 0.75–1.25 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform; disc cupuliform, free, erose, to 1 mm. long, glabrous; pistil about 3 mm. long, the ovary ovoid, glabrous, the style about 0.75 mm. long, the stigma capitate, exserted. Drupe not seen.

Flowers in April at 2400 to 2500 meters.

ECUADOR: LOJA: Namanola, *Espinosae 205* [NY (♀)], *s. n.* [NY (♀)].

37. DAPHNOPSIS ALPESTRIS (Gardn.) Benth. & Hook. f. Gen. 3:192. 1880.

Lagetta alpestris Gardn. in Hook. Lond. Journ. 4:135. 1845. [T.: *Gardner 5849* (♀)!]

Shrubs to 1.5 m. tall, the young branches glabrous. Leaf blades elliptic, obovate or oblanceolate, 2–5 cm. long, 1.0–2.5 cm. broad, obtuse to subacute at the apex, cuneate at the base, thin-coriaceous, glabrous above and below, the costa plane above, emersed below, the primary lateral veins prominulous above and below, arcuate-ascending; petiole 1–3 mm. long. Inflorescences borne from the young leafy or defoliated nodes, dense racemiform, sparsely strigillose and glabrescent, the primary peduncle 4–16 mm. long, the rhachis 1–2 mm. long, the secondary peduncles to 1 mm. long. Staminate flowers: 5–6 per inflorescence; pedicel about 1 mm. long; calyx tube campanulate, 2.0–2.5 mm. long, 1.0–1.5 mm. broad at the orifice, strigillose without, glabrous within; calyx lobes subequal, puberulent within, 1.25–1.5 mm. long, 1.0–1.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted an anther's length above the orifice, exserted, the alternisepalous inserted just below the orifice, subexserted, the anthers orbicular, 0.5 mm. long and broad, subsessile; disc cupuliform, free, to 1 mm. tall, deeply and irregularly lobed, glabrous; pistillode tenpin-shaped, about 2 mm. long, glabrous. Pistillate flowers: 1–4 per inflorescence; pedicel about 1 mm. long; calyx tube urceolate, about 2.5 mm. long, 1 mm. broad at the orifice, minutely puberulent at the base, glabrous within; calyx lobes subequal, puberulent within, about 0.75 mm. long and broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform; disc cupuliform, free, about 0.5 mm. tall, irregularly short-lobed, glabrous; pistil about 2.5 mm. long, the ovary broadly fusiform, glabrous, the style almost obsolete, the stigma capitate, exserted. Drupe ovoid, 5–7 mm. long, 3–4 mm. in diameter, glabrous.

Known from 2000 meters. Flowers from January to May.

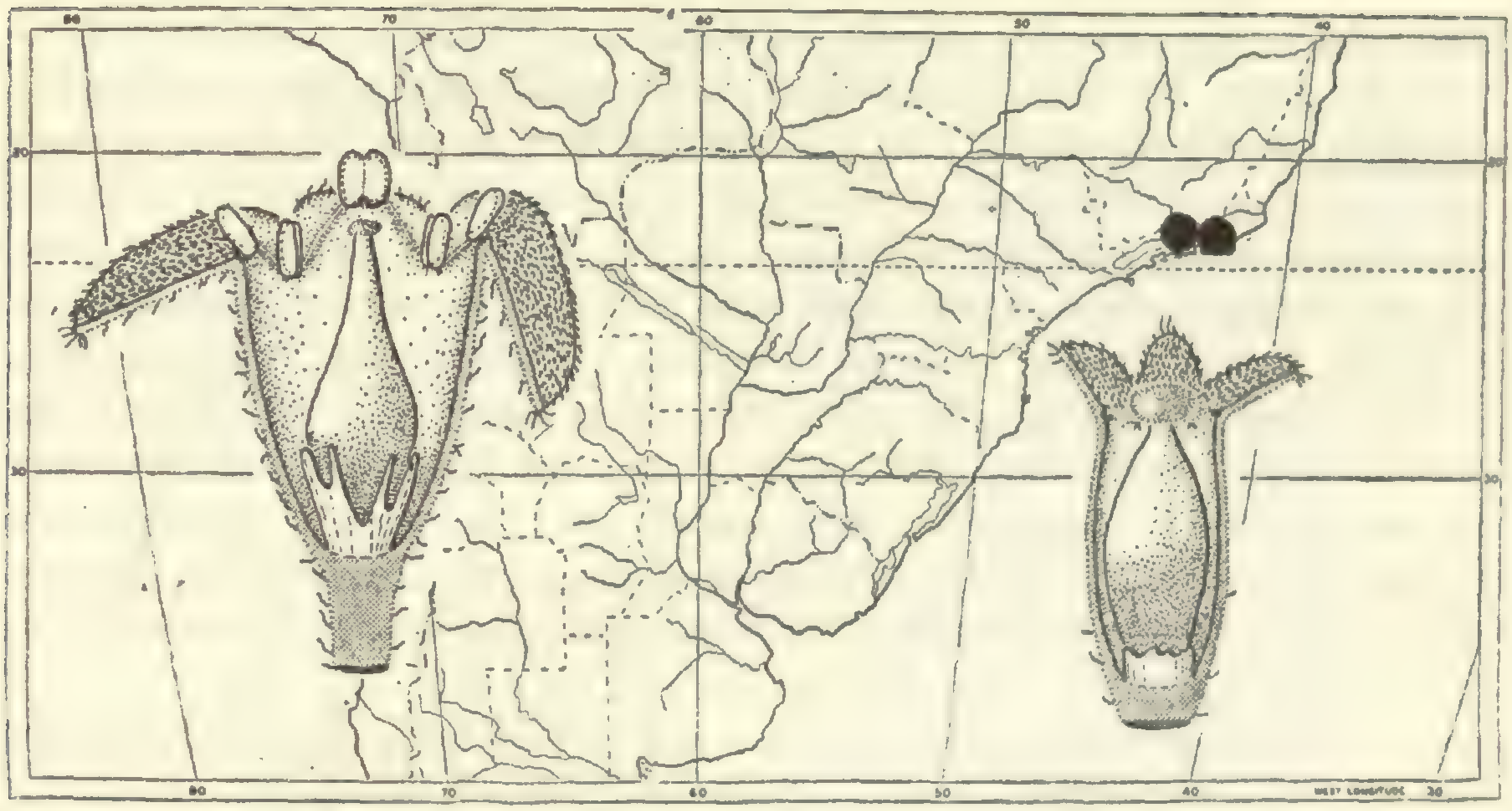

Fig. 42. *Daphnopsis alpestris*

Brasil: rio de janeiro: Organ Mts., *Brade 11501* [R (♀)], *Gardner 5849* [(♀) BM, K, P, W] Rio Orgãos, *Glaziou 3654* [(♂) C, F, P]; Petropolis, *Glaziou 17200* [C (♀), F (?), P (♀)]; Alto Macabé, *Glaziou 17746* [(♀) C, P, US]; Itatiaia, Planalto, *Porto 2761* [MO (♀)].

38. Daphnopsis schwackeana Taub. in Engl. Bot. Jahrb. 12: Beibl. 27:6. 1890. [T.: *Glaziou 6698* (♂)!]

Shrubs, the young branches glabrous. Leaf blades oblanceolate or narrowly elliptic, 10–33 cm. long, 2.0–7.5 cm. broad, acute to subcaudate-acuminate at the apex, cuneate at the base, thin-coriaceous, glabrous above and below, the costa plane to immersed above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 8–12 mm. long. Inflorescences

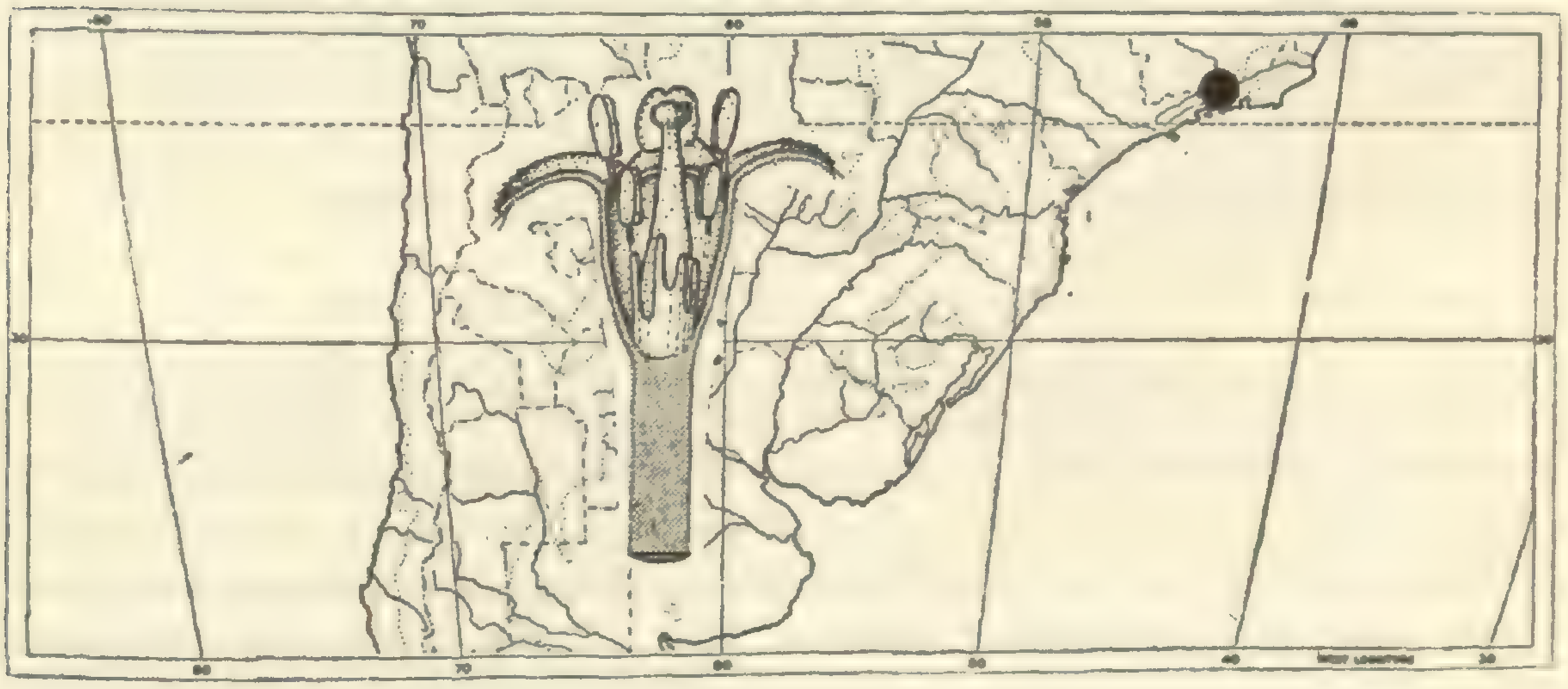

Fig. 43. *Daphnopsis schwackeana*

borne from the young leafy nodes, lax racemiform, glabrous, the primary peduncle 10–30 mm. long, the rhachis 3–10(–20) mm. long, the secondary peduncles 1–4 mm. long. Staminate flowers: 9–15 per inflorescence; pedicel 1.5–2.0 mm. long; calyx tube campanulate, about 1.5 mm. long, 1 mm. broad at the orifice, glabrous; calyx lobes unequal, minutely puberulent within, the outer about 1 mm. long, 0.75 mm. broad, the inner about 1 mm. long, 1.25 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted at the orifice, exserted, the alternisepalous inserted just below the orifice, subexserted to exserted, the filaments 0.25–0.5 mm. long, the anthers more or less orbicular, about 0.5 mm. long and broad; disc of irregular lobes or annular and deeply lobed, free, glabrous; pistillode more or less fusiform, 1.75–2.5 mm. long, glabrous. Pistillate flowers: 9–20 per inflorescence; pedicel about 1.5 mm. long; calyx tube subcampanulate to tubular, 2.0–2.5 mm. long, about 1 mm. broad at the orifice, glabrous; calyx lobes unequal, sparsely puberulent within, the outer 0.75 mm. long, 0.5 mm. broad, the inner 1.0 mm. long, 0.75 mm. broad; petals connate into an obscure faucal annulus; staminodia absent; disc cupuliform, free, deeply and irregularly lobed, about 0.75 mm. tall, glabrous; pistil obovoid, 2.0–2.5 mm. long, glabrous, the style almost obsolete, the stigma capitate, exserted. Immature drupe fusiform, about 6 mm. long, 3 mm. in diameter, glabrous.

Flowers in January.

Brasil: rio de janeiro: Restinga de Maria, *Schwacke 5411* [RB (♂)]; Alto Macabé, *Glaziou 18467* [(♂) C, P]; Mauã, *Ule 4686* [R (♀)]; Teresopolis, Fazenda Boa Fé, *Emygdio 67* [R (♂)], *Emygdio & Filho 79* [R (♂)], *Velloso 433* [R (♂)], *453* [R (♂)], *466* [R (♀)], *469* [R (♂♀)]. without precise locality: *Glaziou 6698* [(♂) C, P], *Bowie & Cunningham s. n.* [BM (♂)], *Pohl s. n.* [M (♂)].

Domke applied the earlier name *gemmiflora* to this species. His decision was based upon observation of the type material of *Coleophora gemmiflora* Miers. Although I have been unable to obtain this same material, except by photograph, I am forced to disagree with Domke and accordingly maintain the epithet of Taubert. Further information concerning this procedure may be found under *D. gemmiflora.*

I have chosen *Glaziou 6698* (P) as the lectotype because the other two specimens cited by Taubert, *Glaziou 4765* and *8251*, are specimens of *D. martii.*

39. Daphnopsis racemosa Griseb. Symb. Fl. Arg. 134. 1879.

Daphnopsis leguizamonis Griseb. ex Gilg, in Engl. & Prantl Pflanzenf. 3[6a]:236. 1894, as syn.
Daphnopsis racemosa var. *leptostachys* Chod. & Hassl. in Bull. Herb. Boiss. ser. II 3:811. 1903. [T.: *Hassler 5040* (♂♀)!]
Daphnopsis longiracemosa Gilg, ex Domke, in Notizbl. 12:728. 1935. [T.: *Ule 9077* (♂♀)!]

Shrubs or small trees, 1–3(–8) m. tall, the young branches glabrous. Leaf blades oblanceolate to obovate, 1–18 cm. long, 1–7 cm. broad, obtuse to acute or rarely acuminate at the apex, subauriculate to auriculate at the base, thin-coriaceous, glabrous above and below, the costa plane above, emersed below, the

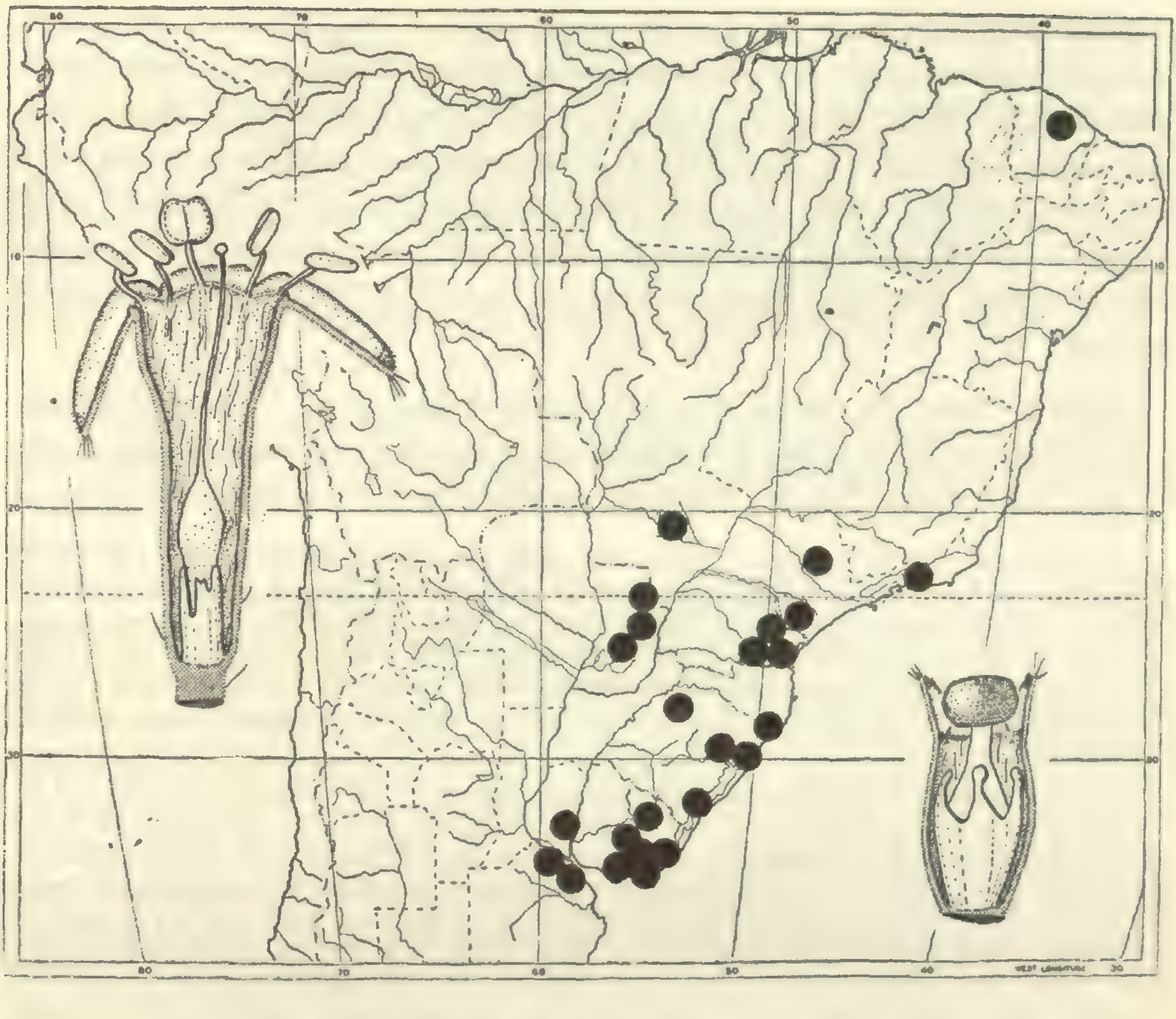

Fig. 44. *Daphnopsis racemosa*

primary lateral veins prominulous above and below, arcuate-ascending; petiole 1–4 mm. long. Inflorescences borne from the young leafy or older defoliated nodes, lax racemiform, essentially glabrous. Staminate inflorescence with the primary peduncle 3–31 mm. long, the rhachis 1–17 mm. long, the secondary peduncles 1–4 mm. long. Staminate flowers: 4–17 per inflorescence; pedicel 0.25–1.5 mm. long; calyx tube tubular, obconic or somewhat campanulate, 3.5–5.5 mm. long, 1.5–2.0 mm. broad at the orifice, essentially glabrous to sparsely villous without, villous within; calyx lobes subequal, generally puberulent within, 1.0–1.5 mm. long, 0.75–1.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted just above the orifice, exserted, the alternisepalous inserted just below the orifice, exserted or subexserted, the anthers orbicular, at most 0.5 mm. long and broad, sessile or on filaments about 0.25 mm. long; disc cupuliform, free, to 2 mm. tall, generally irregular and deeply lobed, glabrous, often orange with yellow lobe apices; pistillode fusiform, borne on a slender gynophore, 3.5–6.5 mm. long, glabrous or villous. Pistillate inflorescence with the primary peduncle 3–28 mm. long, the rhachis 1–60 mm. long, the secondary peduncles 1–4 mm. long. Pistillate flowers: (1–)3–19 per inflorescence; pedicel essentially

obsolete; calyx tube urceolate, 2–3 mm. long, 0.5–1.0 mm. broad at the orifice, essentially glabrous or sparsely villous without, villous within; calyx lobes subequal, puberulent within, 0.5–0.75 mm. long, 0.25–0.75 mm. broad; petals connate into an obscure faucal annulus; staminodia 8, papilliform; disc cupuliform, free, 0.5–1.5 mm. tall, shallowly and irregularly lobed, glabrous; pistil 2.0–3.5 mm. long, the ovary broadly fusiform, glabrous or villous, the style 0.25–1.0 mm. long, the stigma capitate, exserted. Drupe ovoid, 5–6 mm. long, 3–4 mm. in diameter, glabrous.

Generally found in wooded areas but also on alluvial deltas. It may be a highland species which has followed watercourses to become established on the fertile deltas. Flowers from June to November at altitudes of 15 to 900 meters.

ARGENTINA: BUENOS AIRES: Delta-Cruz Colorado, *Parodi 8689* [A (♂)]; Chana Miní-Delta del Río Paraná, *Parodi 8152* [A (♂)]; Delta de la Paraná, near Recreo Naon, *Eyerdam & Beetle 23259* [A (♀)]; Martín García, *Parodi 5289* [W (♀)]; Brazo Largo, *Scala s. n.* [NY (♀)]; Campana, *Krapovickas 2603* [NY (♂)], *Hunziker 1653* [MO (♀)]. ENTRE RÍOS: Concepción del Uruguay, *Lorentz 1653* [(♂) A, B], *5621* [MO (♂), US (♂♀)], *s. n.* [B (?), F (♂♀), US (?), W (?)]; without precise locality, *Lorentz s. n.* [K (♀)].

BRASIL: CEARÁ: Pico alto, Serra de Baturité, *Ule 9077* [K (♀), U(♂), US (♂)]. MATO GROSSO: Lageado, Campo Grande, *Archer & Gehrt 62* [INA (?), NY (♀), US (?)]; Rio Arinos, *Kuhlmann 1068* [R (♀)], *1069* [R (?)], *1070* [R (♀)], *1071* [R (?)], *1072* [R (?)]. PARANÁ: Canguiry, *Capanema s. n.* [RB (♀)]; Curityba, *Dusén 8794* [(♂) S, US], *17173* [S (♂♀), W(♂)], *Tessmann s. n.* [MO (♂♀)], *Stellfeld s. n.* [MO (♂)]; Villa Velha, *Dusén 8055* [(♀) A, F, MO, NY, S], *14823a* [S (♀)]; Balsa Nova, *Dusén 8492* [(♂) F, GH, M, MICH, MO, NY, S]; Piraquara, *Dusén s. n.* [S (s)]; Guarapuava, *Dusén s. n.* [S (?)]; Rio Igassú, *Hatschbach 1436* [S (♂)]; without precise locality, *Sello 4550* [P (♂)], *4643* [P (?)]. RIO DE JANEIRO: Ilha de Caho Frio, *Ule s. n.* [R (♂)]; D. Federal, Mesa do Imperador, *Kuhlmann 48139* [MO (♂)]; without precise locality, *Saint Hilaire 194* [P (♀)]. RIO GRANDE DO SUL: Morro do Gloria, *Rambo 29213* [MO (♀)]; Esteio, *Rambo 41642* [MO (?)]; Cristal, propre P. Alegre, *Rambo 42805* [(♂) IAN, MO]; Cai, *Rambo 42572* [(♂) MO, US, W]; Montenegro, *Heuz 32636* [F (♀)]; Canoas, *Rambo 41766* [(?) MO, W]; Morro da Palicia, P. Alegre, *Rambo 43340* [W (♂)]; around Gravataí, *Rambo 42750* [W (♂)]; Serra dos Taypes, *Schwacke 2666* [RB (?)]; S. Leopoldo, *Beetle 1965* [NY (♂)], *Eugenio 213* [NY (♂♀)], *Leite 1636* [U (♀)], *Rambo 42621* [IAN (?)], *44060* [IAN (♀)]; Pelotas, *Malme 165* [S (♀)]; Quinta, *Malme s. n.* [S (♀)]; Rio Grande, *Malme 140* [S (♀)]; Taimbesinko, *Rambo 52175* [S (♂)]; Fazenda do Arroio prope Osorio, *Rambo 55897* [MO (♀)], *61160* [MO (♂)]; Osorio, *Rambo 48775* [IAN (♂)], *48900* [MO (♀)]; Morretes, ad flumen rio dos Sinos inferius, *Rambo 42826* [W (♀)]; Palmeira, *Bornmüller 730* [A (♂)]; Montevideo to P. Alegre, *Sello 866* [(♀) B, US]; without precise locality, *Vianna 148* [MO (♂)], *Netto s. n.* [R (♂)], *Ihering 10* [R (♂)], *d'Arauja 46* [R (♀)]. SANTA CATARINA: Sombria, *Reitz 1169* [(♂) S, W], *1754* [NY (♀), US (♂♀)]; *s. n.* [R (♂)]; Tubarão, *Ule 1295* [(♂) P, R]; without precise locality, *Tweedie s. n.* [K (♂♀)]. SÃO PAULO: Jaguariahyva, *Dusén 10039* [S (♂)], *13091* [S (♀), US (?)], *15114* [(♀) S, W], *17105* [(♂) S, US W]; Serra do Bocaina, *Glaziou 19814* [P (?)]; without precise locality, *Gaudichaud 98* [P (♀)]. WITHOUT PRECISE LOCALITY: *Sello s. n.* [B (?), US (♀)], *Gaudichaud 19* [P (♀)].

PARAGUAY: CAAGUAZÚ: vicinity of Caaguazú, *Hassler 9402* [NY (♂), P (♂♀), W (♂)]; vicinity of the river Yhú, *Hassler 9659* [(♀) NY, P, W]; Iter to "Yerbales", Sierra de Maracajú, *Hassler 5040* [(♀) MO, NY, P, S, W]. GUAIRÁ: Villarrica, *Jörgensen 3978* [(♂) A, F, NY, S]. WITHOUT PRECISE LOCALITY: Colonia Gonzales, *Lindman s. n.* [S (♂)].

URUGUAY: CERRO LARGO: Río Negro, Palleros, *Gallinal, Aragone, Bergalli, Campal & Rosengurtt PE-4633 1/2* [U (♂)]; Arroyo Lapallar (?), *Schroeder 15443* [S (?)]. FLORIDA: Estancia Rincón de Santa Elena, Picada Castro, Arroyo Mansavillagra, *Rosengurtt & Gallinal 5897* [(♂) MO, S]. MALDONADO: Sierra Animas, *Herter 5050* [(♀) A, F, M, MO, NY, RB, U, US]; Abra Perdomo, *Herter 5279* [(♀) M, NY]. MINAS: Estia Montano, *Schroeder 19685* [S (?)]; Lavalleja, Cerro de Arequita, *Legrand 1135* [F (♂)]. MONTEVIDEO: Montevideo, *Courbon s. n.* [P (♀)], *Kuhlmann s. n.* [RB (♀)]. ROCHA: Castillos, *Herter 6211* [US (?)]. TREINTA Y TRES: Tacuari, *Herter 94009* [(♀) A, F, MO, U]; Carajá del Olimer, 2 Leguas de Sta Clara, *Rosengurtt B-4874* [(♂ ♀) A, MO, U, US]. WITHOUT PRECISE LOCALITY: *Sello 4550* [(♂) NY, US].

Commonly known as *imbira*.

Grisebach was not explicit in the designation of a type specimen. His description was based on a specimen, possibly collected by Lorentz, from Concepción de Uruguay in Argentina. The specimen included both staminate and pistillate material.

The rather large geographic disjunction that exists between the plants of the province of Ceará in Brasil and the rest of the range is accompanied by a single minor morphological discrepancy in both the staminate and pistillate flowers. In the staminate flowers the plants of Ceará have sessile anthers while those of the remainder of the range have shortly filamented anthers. In the pistillate flowers the plants of Ceará have a villous ovary; the ovary in the rest of the plants is glabrous. The Ceará segment has been delimited as a separate species, *D. longiracemosa* Domke. There is some question whether it merits subspecific or varietal status but in the light of the uncertainty of the range I feel the group is best treated as a single species.

There appears to be some basis for the named variety, *leptostachys* Hassl., because of the elongate inflorescence. The inflorescence of these specimens has an elongate rhachis which has been formed by elongation between the flowers. In all other respects the specimens are similar to the rest of the species, so I have not maintained this variety.

This is the most widespread species of the subgenus NEIVIRA. In addition to those epithets included in the synonymy several additional manuscript names can be found.

The location of the Sello specimens was determined from the list of Urban in Engl. Bot. Jahrb. 17:196. 1893.

40. DAPHNOPSIS CORIACEA Taub. in Engl. Bot. Jahrb. 12: Beibl. 27:7. 1890.
[T.: *Glaziou 8911* (♂)!]

Leaf blades obovate to oblanceolate, 8–16 cm. long, 2–8 cm. broad, obtuse to subacute at the apex, cuneate at the base, thick-coriaceous, glabrous above and below, the costa plane to immersed above, emersed below, the primary lateral veins prominulous above and below, arcuate-ascending; petiole 15–28 mm. long. Inflorescences borne from the young leafy nodes, lax racemiform, hirtellous and glabrescent. Staminate inflorescence with the primary peduncle 15–20 mm. the rhachis 5–10 mm. long, the secondary peduncles 1–3 mm. long. Staminate

flowers: 15–25 per inflorescence; pedicel 0.5–1.5 mm. long; calyx tube broadly campanulate, about 4 mm. long, 4 mm. broad at the orifice, minutely and sparsely puberulent without, villous within; calyx lobes subequal, puberulent within, 2.0–2.5 mm. long, 1.5–1.75 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted about an anther's length above the orifice, exserted, the alternisepalous inserted at the orifice, exserted, the filaments 0.5–1.0 mm. long, the anthers orbicular, about 0.75 mm. long, 1 mm. broad; disc cupuliform, free, broadly lobed, to 2 mm. tall; pistillode lageniform, about 5 mm. long, densely villous. Pistillate inflorescence with the primary peduncle 14–30 mm. long, the rhachis 7–25 mm. long, the secondary peduncles 1–3 mm. long. Pistillate flowers: 8–25 per inflorescence; pedicel about 1.5 mm. long; calyx tube urceolate, 2.5–3.0 mm. long, about 1.5 mm. broad at the orifice, minutely and sparsely puberulent without, villous within; calyx lobes as in staminate flowers; staminodia 8, papilliform; disc cupuliform, free, deeply lobed, glabrous; pistil about 3.5 mm. long, the ovary ovoid, villous at least towards the base, the style 1.0–1.5 mm. long, the stigma capitate, exserted. Drupe not seen.

Flowers in May and June.

Fig. 45. *Daphnopsis coriacea*

BRASIL: RIO DE JANEIRO: summit of Tingua, *Glaziou 8911* [C (♂), F (fragment, s), NY (?), P (?)]; Alto Macabé, *Glaziou 18469* [C (♂), F (?), P (♂), US (♂)]; Organ Mts., *Glaziou 3639* [C (♀), F(♂), P (♀), US (?)]; Morro de Bandeira, *Glaziou 14226* [C (♀), P (♂ ♀)]; Parque Nac. de Serra dos Orgãos, *Dionisio & Otarrio 339* [RB (♂)], *Brade 10924* [R (♂)]; Petropolis, *Glaziou s. n.* [R (♂)].

Taubert based this species on *Glaziou 8911* and *14226*. The specimens which he saw apparently lacked locality data, but this is now supplied from duplicates which he had not seen.

The staminate flowers sometimes contain an extra stamen, in which case the normal position of the stamens is somewhat modified.

41. DAPHNOPSIS SELLOWIANA Taub. in Engl. Bot. Jahrb. 12: Beibl. 27:7. 1890. [T.: *Glaziou 15383* (♂)!]

Shrubs or trees (?), the young branches tomentose and glabrescent. Leaf blades narrowly elliptic to obovate or oblanceolate, 4.5–14.0 cm. long, 1.5–4.0 cm. broad, acute to obtuse at the apex, cuneate at the base, coriaceous, glabrous above, sericeous or tomentose to glabrescent below, the costa emersed above, immersed below, the primary lateral veins obscure, arcuate-ascending, the margins revolute; petiole 2–4 mm. long. Inflorescences borne from the young leafy or defoliated nodes, umbelliform, hispidulous, the primary peduncle 1–5 mm. long, the rhachis about 0.5 mm. long, the secondary peduncles to 2 mm. long. Staminate flowers: 5–15 per inflorescence; pedicel 0.5–1.0 mm. long; calyx tube obconic, 3–4 mm. long, 1–2 mm. broad at the orifice, hispidulous without, villous within; calyx

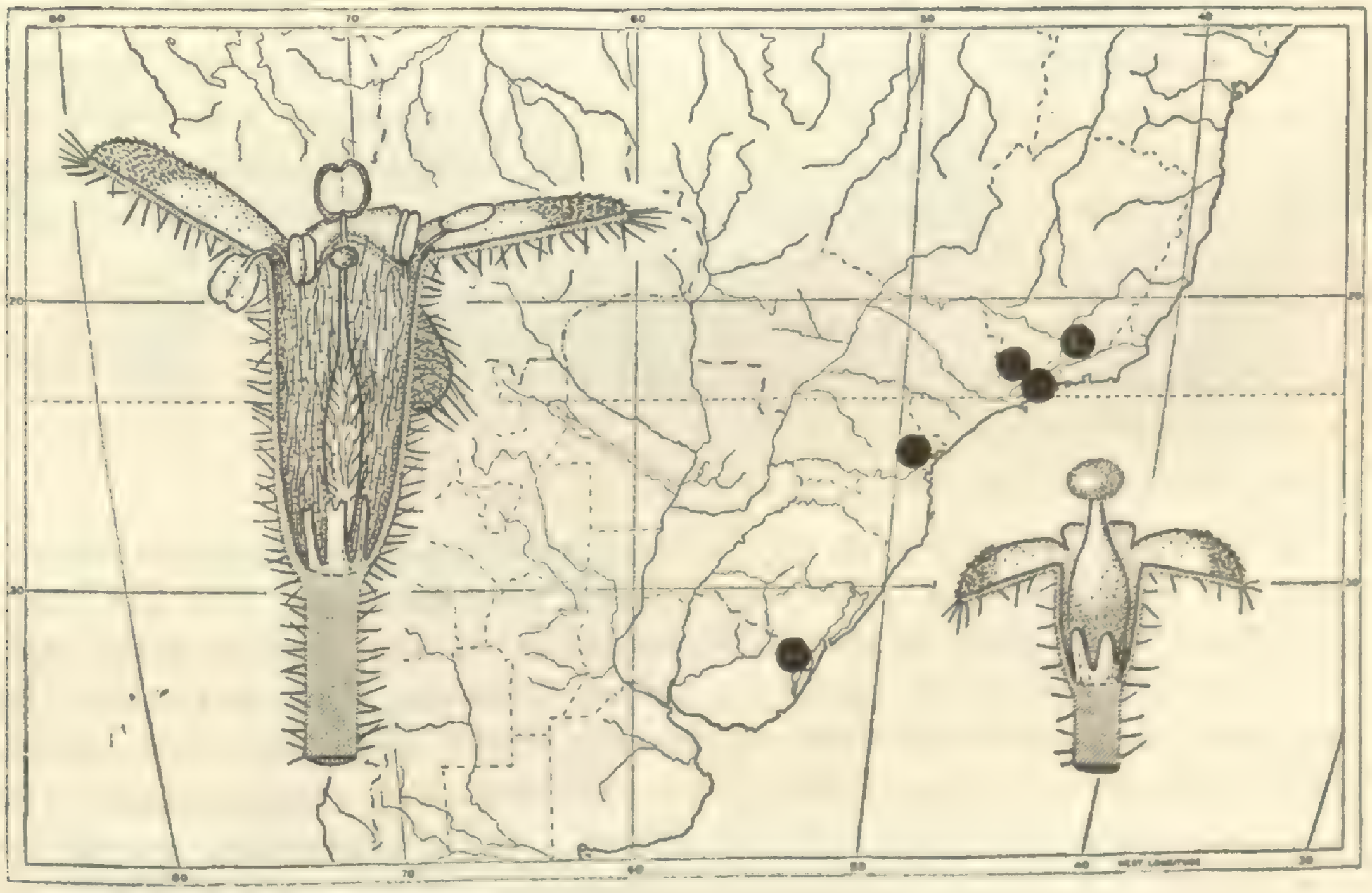

Fig. 46. *Daphnopsis sellowiana*

lobes unequal, puberulent within, the outer 2 mm. long, 1.5 mm. broad, the inner to 1.5 mm. long, 1.0–1.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted from just above the orifice to several anthers' lengths above the orifice, the alternisepalous inserted at the orifice, exserted, the filaments about 0.25 mm. long, the anthers orbicular, 0.25–0.5 mm. long and broad; disc cupuliform, free, deeply or shallowly lobed, to 1.5 mm. tall, glabrous; pistillode fusiform, borne on a gynophore, 3.0–4.5 mm. long, villous. Pistillate flowers: 4–10 per inflorescence; pedicel 0.5–0.75 mm. long; calyx tube campanulate, about 1 mm. long, 0.5–0.75 mm. broad at the orifice, hispidulous without, glabrous within; calyx lobes subequal, puberulent within, 0.75–1.0 mm. long and broad; petals connate into an obscure faucal annulus; staminodia 0; disc cupuliform, free, lobed almost to the base, to 0.5 mm. tall, glabrous; pistil 1.25–2.0 mm. long, the ovary ovoid, glabrous or villous at the base, the style to 0.5 mm. long, the stigma capitate, exserted. Drupe ovoid, 4–5 mm. long, 3–4 mm. in diameter, glabrous.

Flowers in June and July.

Brasil: minas gerais: Barbacena, *Glaziou 15383* [(♂) C, F, MA, P, US]; Caldas, *Glaziou s. n.* [P (♂)]; without precise locality, *Widgren s. n.* [R (♀)]. paraná: Serrinha, *Dusén 6858* [(♀) F, M, MICH, MO, S], *7327* [(♀) NY, S. US], *Hatschbach 2281* [US (♂)]; without precise locality, *Sello 4643* [B (♂), C (♀), K (♂♀), NY (♀), P (♂), US (♀)]. rio grande do sul: without precise locality, *Sello 858* [(♂) P, US]. são paulo: Bananal, Sertão do Rio Vermelho, *Brade 15899* [MO (♀)]. without precise locality: *Sello s. n.* [US (♀)].

Uruguay: without precise locality: *Sello 86* [B (♂)].

In the original description Taubert cited three specimens, *Sello 858, 4643* and *Glaziou 15383*, all without location. I have chosen the *Glaziou 15383* (P) specimen as the lectotype.

The Sello collections have been tentatively placed by use of the Sello numbers previously mentioned. *Sello 86* is from southern Uruguay and *Sello 858* from between Montevideo and Porto Alegre; I have compromised by marking the map on the border between Uruguay and Brasil. It is surprising that this species is not known from other collections if it is really to be found in this area.

42. Daphnopsis beta Taub. in Engl. Bot. Jahrb. 12: Beibl. 27:5. 1890. [T.: *Glaziou 11481* (♂)!]

Daphnopsis longifolia Taub. loc. cit. 9. 1890. [T.: *Glaziou 8252* (♀)!]

Shrubs or small trees to 5 m. tall, the young branches very sparsely to densely tomentose and glabrescent. Leaf blades elliptic to oblanceolate, 3–30 cm. long, 1.0–5.5 cm. broad, blunt or acute to acuminate at the apex, cuneate at the base, thin-coriaceous, glabrous or sparsely to densely tomentose above and below, the costa plane above, emersed below, the primary lateral veins prominulous above, prominent below, arcuate-ascending; petiole 3–20 mm. long. Inflorescences borne from the axils of the young leafy or defoliated nodes, racemiform, sparsely to densely tomentose. Staminate inflorescence with the primary peduncle 1–23 mm. long, the rhachis 1–8 mm. long, the secondary peduncles 1–3 mm. long. Staminate

flowers: 8–20 per inflorescence; pedicel 0.5–1.5 mm. long; calyx tube narrowly to broadly campanulate, 1.5–3.0 mm. long, 1.5–4.0 mm. broad at the orifice, tomentose without, densely villous within; calyx lobes subequal, indefinitely papillate or minutely tomentose within, 1.5–2.5 mm. long, 1.5–2.0 mm. broad; petals absent; antisepalous stamens inserted about 2 anthers' lengths above the orifice, exserted, the alternisepalous inserted at the orifice, exserted, the filaments 0.25–1.5 mm. long, the anthers orbicular, about 0.5 mm. long and broad; disc cupuliform, free, deeply or shallowly lobed, glabrous; pistillode ovoid, 2.0–3.5 mm. long, densely villous. Pistillate inflorescence with the primary peduncle 0.25–27.0 mm. long, the rhachis 0.25–1.0 mm. long, the secondary peduncles 0.25–1.0 mm. long. Pistillate flowers: 5–15 per inflorescence; pedicel 0.5 mm. long; calyx tube campanulate, 1.0–1.75 mm. long, about 1 mm. broad at the orifice, tomentose without, glabrous or sparsely villous within; calyx lobes subequal, indefinitely papillate or minutely tomentose within, 0.75–1.25 mm. long, 0.75–1.0 mm. broad; petals absent; staminodia absent; disc cupuliform, free, irregularly short-lobed, glabrous; pistil 1.5–2.5 mm. long, the ovary obovoid, densely villous, the style about 0.5 mm. long, the stigma capitate, exserted. Drupe ovoid, 6–7 mm. long, 3–4 mm. in diameter, tomentose and glabrescent.

A small woodland species capable of flowering in any season.

Fig. 47. *Daphnopsis beta*

BRASIL: GOIÁS: Bord du Rio Bananal au Chico Lobo, *Glaziou 22019* [P (♀)]. MINAS GERAIS: Caldas, *Regnell II 127* [K (♂), R (♂), US (♂♀)]; Serro de Ouro Preto, *Schwacke 9465* [P (♂)]; without precise locality, *Widgren 1025* [NY (♂)]. PARANÁ: Villa Velha, *Dusén 14823* [S (♂)]; Ypiranga, *Dusén 17286* [(?) S, US]; Volta Grande, *Dusén 11978* [S (s)]; Fortaleza, *Dusén 12790* [S (?), W (♂)]; Guaratuba, *Dusén 13638*

[(s) S, US]; Cerro Azul, *Hatschbach 730* [(♂) MO, S]; S. José dos Pinhaes, Estrada Curitiba-Joinville, entre Rios S. Joaõzinho e Iteraré, *Hatschbach 1252* [(♂) S, US]; S. José dos Pinhaes, Estr. Curitiba-Joinville, Alto da Serra, *Hatschbach 1449* [S (♂)]; Piraquara, *Dusén 3248a* [S (s)], *Hatschbach 1508* [S (♂)]; Ponta Grossa, *Dusén s. n.* [S (s)]; Marumby, *Dusén 14061* [(♂) S, US]; Carvalho, *Dusén 13010* [NY (?), S (♀), US (s)]; without precise locality, *Jousson 788a* [S (s)], *Sello 4644* [(♂) P, US]. RIO DE JANEIRO: Nova Friburgo, *Glaziou 8252* [C (?), F, (?), P (♀), RB (?), US(s)], *12141* [F (fragment, s), P (♀)], *19813* [C (♂), F (♂ ♀), P (♀), US (♂)]; Itatiaia, Serra Negra, *Porto 2872* [RB (♂)]; Fazenda Imperial de Sta. Cruz, *Glaziou 11481* [(♂) C, F, P, US, W]; Serra do Picú, *Lanstyack 147* [MO (?)]. ST. CATARINA: S. Bento, *Schwacke s. n.* [R (s)]; Matas Pedro, Brusque, *Klein 142* [US (♂)]; Biguassu, *Rambo 50360* [(♀) MO, S]; propre Joinville, *Schwacke 1334* [RB (♀)], *3278* [MO (?)]. SÃO PAULO: São Bernardo, *Wettstein & Schiffner s. n.* [W (♂)]; Santos, *Kuhlmann s. n.* [RB (♀)]; Mogi das Cruzes, *Hashimoto 50* [RB (♀)]; Bocaina, *Brade 2100* [MO (?)]; without precise locality, *Gaudichaud 94* [P (♀)]. WITHOUT PRECISE LOCALITY: *Burchell 4700* [K (♂ ♀), P (♀)].

Known as *beta, imbira* and *embirucu.*

Daphnopsis beta and *D. longifolia* represent different segments of a rather variable species. They were both described in the same work in 1890, so neither has priority over the other. I have chosen to maintain the *beta* epithet because of the inadequacies of the other. At least three other species of the genus have longer leaves. The description of *D. beta* is based upon *Glaziou 11481* and *Sello 4644.* I have chosen *Glaziou 11481* (P) as the lectotype.

The species appears variable in leaf shape, size and pubescence; flower size and pubescence; disc and filament length.

Many specimens bear unpublished manuscript names of Heimerlich which appear to be without foundation.

Hatschbach 730 has a flower with 5 calyx lobes, all of which appear normal. Only eight stamens are present.

43. DAPHNOPSIS **sanctae-teresae** Nevl. spec. nov.

Frutices nisi arbores. Folia oblanceolata 12–38 cm. longa 3–10 cm. lata apice acuta basi cuneata coriacea glabra, venis primariis lateralibus arco-ascendentibus; petiolo 3–10 mm. longo. Inflorescentia mascula racemiformis; pedunculo primario 4–11 mm. longo; rhachide 2–5 mm. longo; pedunculis secundariis ca. 0.5 mm. longis. Flores masculi 4–10 per inflorescentia; pedicello 1.5–2.5 mm. longo; calyce obconico ca. 4.5 mm. longo 1.5–2.0 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus glabris 1.0–1.5 mm. longis et latis; petalis in annulum brevissimum connatis; staminibus in planis 2, filamentis ca. 0.5 mm. longis, antheris orbicularis 0.25 mm. longis et latis; disco cupuliformi libero glabro; pistillodio lageniformi 2.5–3.5 mm. longo pubescente. Inflorescentia feminea racemiformis; pedunculo primario 8–14 mm. longo; rhachide 10–18 mm. longo; pedunculis secundariis ca. 0.25 mm. longis. Flores feminei 8–15 per inflorescentia; pedicello ca. 0.5 mm. longo; calyce campanulato 1.25 mm. longo 1 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus glabris 1.25 mm. longis 1 mm. latis; petalis 0; staminodiis 0; disco cupuliformi libero glabro; pistillo ca. 2.75 mm. longo ovario ovato glabro stigmate capitato exserto. Fructus non vidi. HOLOTYPUS: *Ducke & Lima 111* (IPA).

Flowers in May.

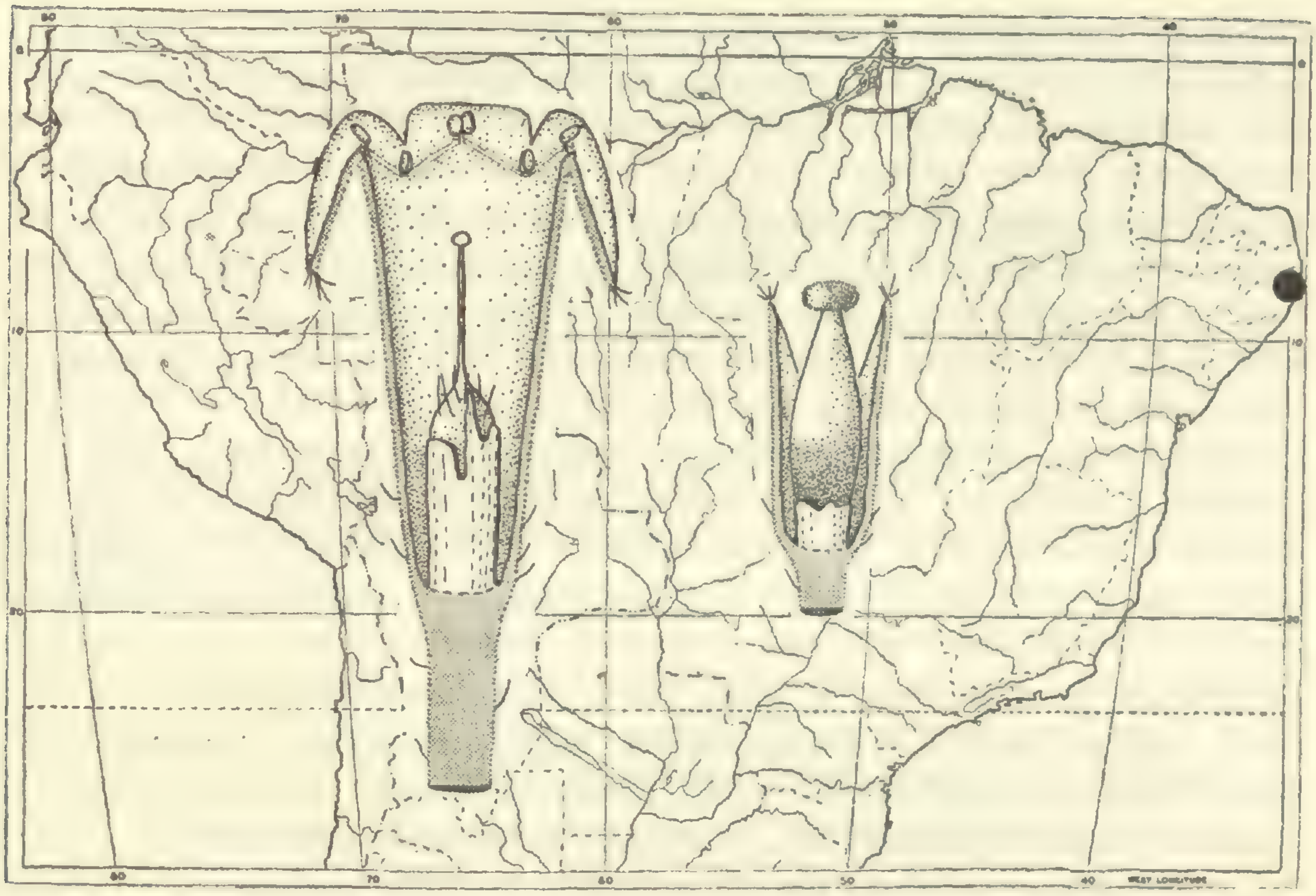

Fig. 48. *Daphnopsis sanctae-teresae*

BRASIL: BAHIA: Ilhéus, *Velloso 941* [R (♀)]. PERNAMBUCO: Pe. Goiana, Sta. Tereza, *Ducke & Lima 111* [(♀) IAN, IPA, R]; Recife, Mata de Dois Irmãos, *Lima 49-214* [(♂) IAN, IPA].

According to Lima the plant is known as *gauxama*.

This is the only species that I have observed to have petals in one condition in the staminate flower and in another in the pistillate flower. Since the pistillate flower also lacks staminodia it is possible that something has interfered with the formation of both the petals and the staminodia.

44. DAPHNOPSIS MARTII Meissn. in Mart. Fl. Bras. 5[1]:66, *t. 28. f. 2.* 1895. [T.: *Martius 119* (♂)!]

Daphnopsis martii var. *congregata* Domke, in Notizbl. 12:730. 1935. [T.: *Brade 14663* (♀)!]

Shrubs to 2 m. tall. Leaf blades elliptic to oblanceolate or obovate, 10–33 cm. long, 4–12 cm. broad, acute to acuminate or subcaudate-acuminate at the apex, cuneate at the base, thin-subcoriaceous, sericeous (?) and glabrescent above and below, the costa plane above, emersed below, the primary lateral veins prominent above and below, arcuate-ascending; petiole 5–10 mm. long. Inflorescences borne from the young leafy or defoliated nodes, dense racemiform, hispidulous. Staminate inflorescence with the primary peduncle 4–10 mm. long, the rhachis 0.5–2.0 mm. long, the secondary peduncles 1–4 mm. long. Staminate flowers: 7–15 per in-

florescence; pedicel about 1 mm. long; calyx tube obconic, about 1.5 mm. long, 1.25 mm. broad at the orifice, hispidulous without, glabrous or villous within; calyx lobes subequal, indefinitely papillate within, about 1 mm. long, 0.75–1.25 mm. broad; petals absent; antisepalous stamens inserted about an anther's length above the orifice, exserted, the alternisepalous inserted at the orifice, subexserted, the anthers orbicular, about 0.75 mm. long and broad, subsessile; disc cupuliform, free, deeply and narrowly lobed, to 1 mm. tall, glabrous; pistillode fusiform, about 2 mm. long, densely villous. Pistillate inflorescence with the primary peduncle 1–8 mm. long, the rhachis 0.5–5.0 mm. long, the secondary peduncles 1–3 mm. long. Pistillate flowers: 5–10 per inflorescence; pedicel about 1 mm. long; calyx tube urceolate, 2.0–2.25 mm. long, 0.75 mm. broad at the orifice, hispidulous without, glabrous or villous within; calyx lobes subequal, indefinitely papillate within, 0.75 mm. long, 0.5 mm. broad; petals absent; staminodia 4, papilliform, the alternisepalous missing; disc cupuliform, free, very irregularly lobed, to 1 mm. tall, glabrous; pistil 3 mm. long, the ovary ovoid, sparsely to densely villous, the style about 1 mm. long, very thick, the stigma capitate, exserted. Drupe ovoid, 6–7 mm. long, 3–4 mm. in diameter, villous and glabrescent.

Found in wooded areas where it flowers from August to December.

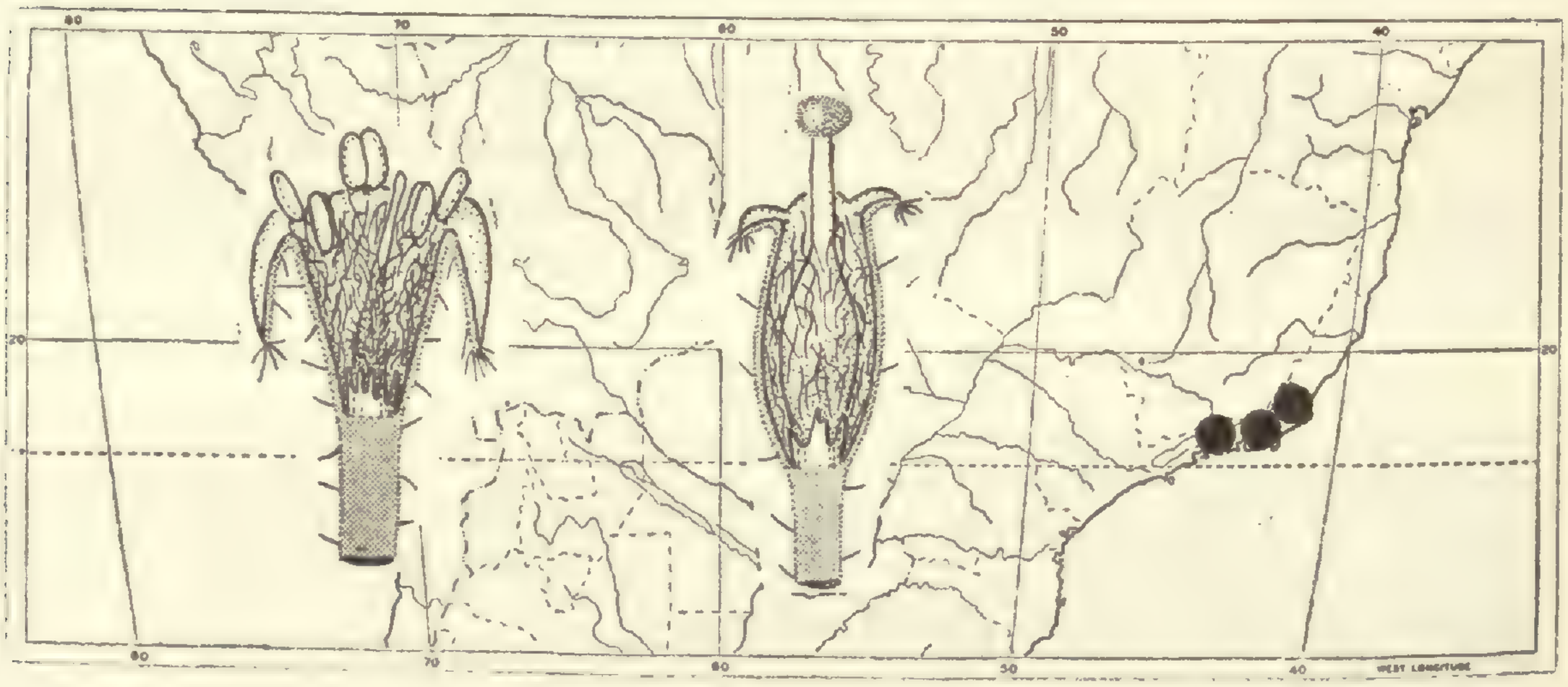

Fig. 49. *Daphnopsis martii*

Brasil: rio de janeiro: Corcovado, *Martius 119* [M (♂)], *Schwacke 7302* [RB (♀)], *8989* [RB (♂)], *Ducke & Kuhlmann 6150* [RB (♀)], *16374* [RB (♂)], *Gaudichaud 15* [P (♀)], *Glaziou 2633* [P (♂)], *18466* [(♂) C, P]; sylvis ad Rio de Janeiro, *Martius 119*^{bis} [M (s)]; Rio, *Lützelburg 263* [M (?)]; Chamin du Macao, *Glaziou 9572* [C (♂), P (?), US (?)]; Serra du Estrella, *Brade 10523* [R (♂)], *Glaziou 8251* [C (♀), F (♂), P (♂)], *Ducke & Kuhlmann 19159* [RB (♀)]; Tijuca, *Glaziou 4765* [(♂) C, P, US], *Brade 10522* [R (♂)], *Ule 3277* [R (♂)], *Ducke 21333* [RB (♀)], *Markgraf & Brade 3086* [RB (♂)]; Serra du Carioca, *Brade 21784* [RB (♂)], *s. n.* [R (♂)]; Mattas du Gavea (?), *Constantino 2276* [RB (♂)]; Serra du Petropolis, *Buarte 1489* [RB (♂)], *Moura 1051* [B (♂)]; Serra dos Orgãos, *Pereira 180* [RB (♀)]; Matos du V. Chineza, D. Federal, *Occhioni 181* [RB (?)]; Sta. Magdalena, *Lima 253* [RB (♂)], *317* [RB (♂)]; Itatiaia, *Brade 14663* [RB (♀)], *14664* [RB (♀)]; Rio Paqueques, *Mello & Brade s. n.*

[MO (♂)], *Markgraf 10005* [RB (♂)]; Serra da Cautareira, *Navarro 59* [RB (?)]; Teresopolis, *Brade 9221* [R (♂)], *Emygdio & Filho 867* [R (♂)], *Emygdio & Velloso 36e498* [R (♂)], *Sampaio 2497* [R (♂)], *Barros 1031 & 1125* [MO (♂ ♀)]; without precise locality, *Glaziou 2633* [C (?)], *20472* [C (?)].

Known as *pau de embira*.

A variable species which is poorly understood because of the paucity of good flowering material. Staminate flowers at anthesis are particularly difficult to find.

Martius 119 represents a split collection, part collected at Corcovado and part collected at Rio.

45. DAPHNOPSIS GEMMIFLORA (Miers) Domke, in Notizbl. 13:388. 1936.

Coleophora gemmiflora Miers, in Ann. Nat. Hist. ser. II. 6:197. 1851. [T.: *Miers f. s. n.* (♂) photo !]

Daphnopsis schwackeana var. *itatiaiensis* Domke, in Notizbl. 12:731. 1936. [T.: *Brade 13990* (s)!]

Trees. Leaf blades oblanceolate, 40–64 cm. long, 9–14 cm. broad, acute at the apex, cuneate at the base, coriaceous, glabrous above and below, the costa plane above, emersed below, the primary lateral veins prominent above and below, often parallel with the costa for a few millimeters before becoming arcuate-ascending; petiole 10–18 mm. long. Inflorescences from the older defoliated nodes, lax racemiform, glabrous, the primary peduncle 3–16 mm. long, the rhachis 5–20 mm. long, the secondary peduncles 1.0–2.5 mm. long. Staminate flowers: 12–20 per inflorescence; pedicel obsolete; calyx tube narrowly obconic, 3.0–3.5 mm. long, 1.0–1.5

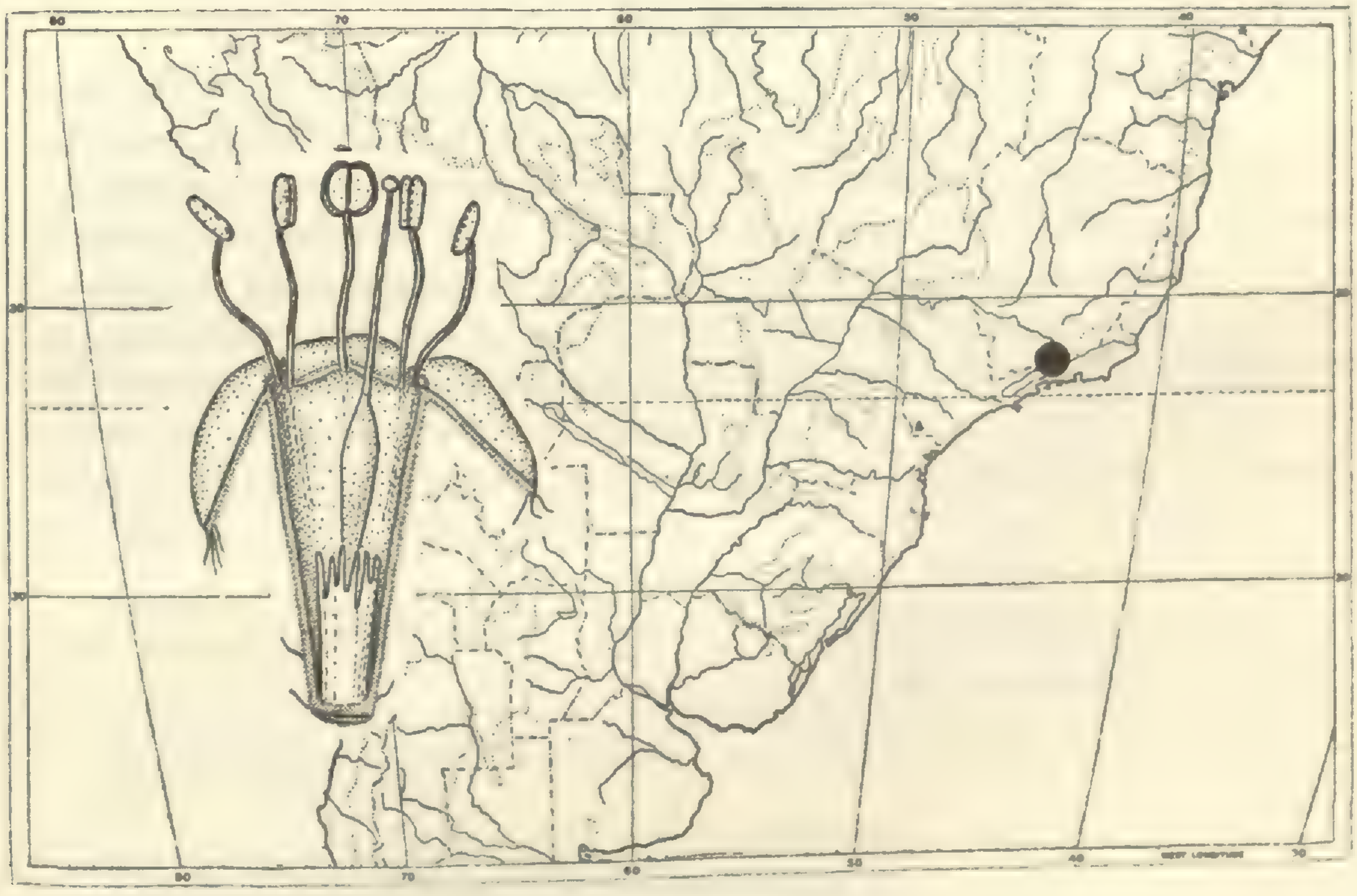

Fig. 50. *Daphnopsis gemmiflora*

mm. broad at the orifice, sparsely puberulent without, glabrous within; calyx lobes subequal, indefinitely papillate within, 1.5–2.0 mm. long, 1.0–1.5 mm. broad; petals connate into an obscure faucal annulus; antisepalous stamens inserted at the orifice, exserted, the alternisepalous inserted just below the orifice, exserted, the filaments about 1.5 mm. long, the anthers orbicular, about 0.5 mm. long and broad; disc cupuliform, free, about 1.5 mm. tall, long-lobed, glabrous; pistillode borne on a gynophore, fusiform, ca. 5.5 mm. long, glabrous. Pistillate flowers and fruit not seen.

Flowers in August and September.

BRASIL: RIO DE JANEIRO: Parque Nac. Itatiaia, Almirante, *Pereira, Egler & Graziela 76* [RB (♂)]; Itatiaia, *Dusén 736* [R (♂)], *Brade 13990* [RB (s)]; Igassú, *Miers f. s. n.* [BM (♂) photo].

This poorly known species appears to be closely related to *D. schwackeana*. There has been considerable difficulty in associating the name *gemmiflora* to the proper specimens. Domke applied it to *D. schwackeana* but the Miers specimen differs from that species in that the inflorescences are borne from the young leafy nodes. Fertile material of Domke's *D. schwackeana* var. *itatiensis* has recently come to light and it is similar to the Miers collection in that it was collected from large trees; the inflorescences are borne from the old defoliated nodes and the staminate flowers appear similar. Admittedly, there are a few discrepancies, i.e. exsertion or inclusion of the pistillode, pubescence of the pistillode and length of the filaments.

The pistillode bears ovules which may or may not be functional. There is a possibility that this species is functionally bisexual but I cannot be certain.

46. DAPHNOPSIS **boliviana** Nevl. spec. nov.

Frutices usque 1 m. alti. Folio elliptica usque oblanceolata 20–27 cm. longa 7.0–9.5 cm. lata apice acuta basi cuneata coriacea glabra, venis primariis lateralibus arco-ascendentibus; petiolo 8–10 mm. longo. Inflorescentia mascula racemiformis; pedunculo primario 20–45 mm. longo; rhachide 5–20 mm. longo; pedunculis secundariis 1–2 mm. longis. Flores masculi 15–25 per inflorescentis; pedicello 1.5 mm. longo; calyce campanulato 2.0–2.5 mm. longo 1.5 mm. lato extus pubescente intus glabro; calycis lobis subequalibus intus glabris 1.0–1.25 mm. longis 1 mm. latis; petalis in annulum brevissimum connatis; staminibus in planis 2, antheris oblongis 0.5 mm. longis 0.25 mm. latis sessilibus; disco cupuliformi libero lobato glabro; pistillodio lageniformi ca. 2.5 mm. longo glabro. Flores feminei nec fructus non vidi. HOLOTYPUS: *Pearce s. n.* (K).

Found in shady woods in the 4–500 ft. zone. Flowers in January.

BOLIVIA: Moro Yungas, *Pearce s. n.* [K (♂)].

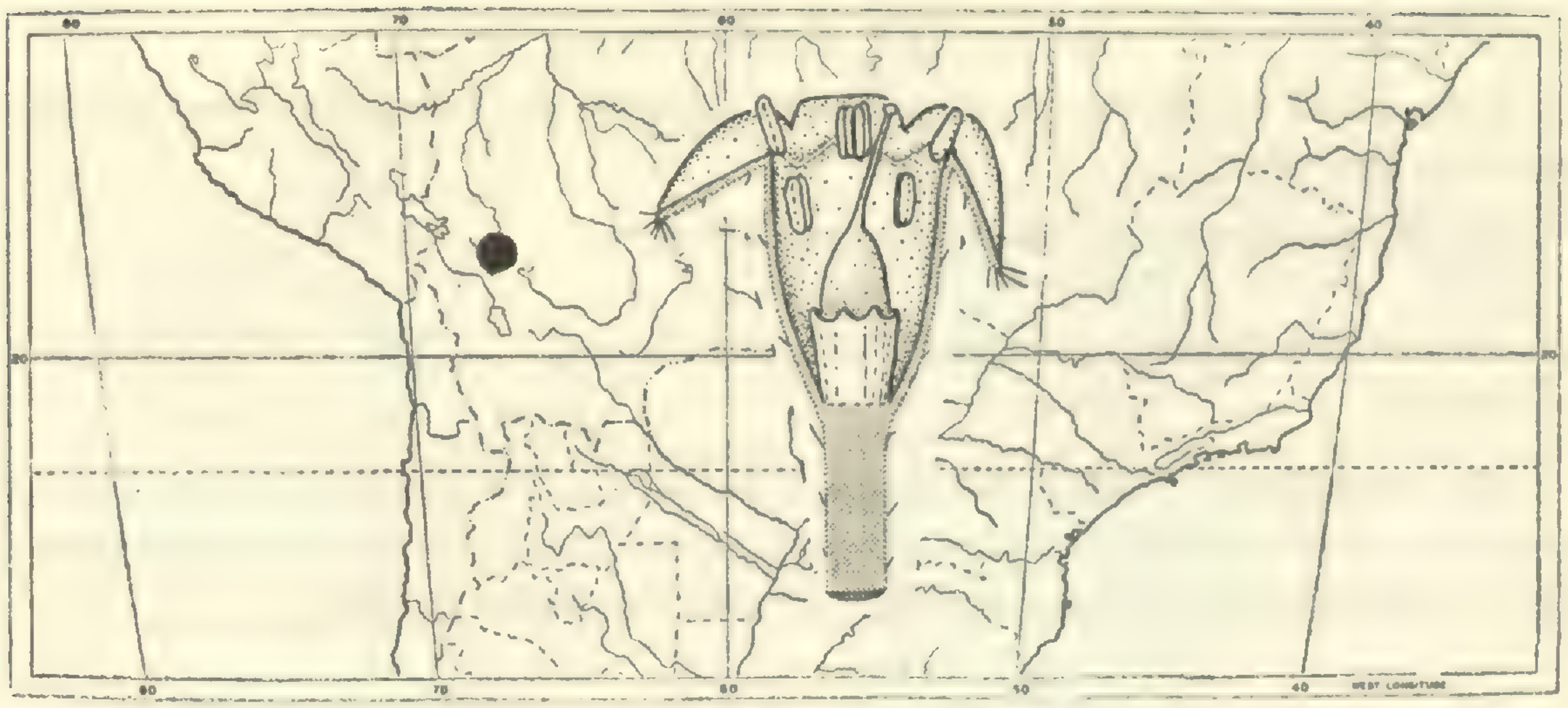

Fig. 51. *Daphnopsis boliviana*

Species of Undetermined Status

1. Bosca stupacea Velloso, Flor. Flumin. 142. 1881; Icon *t. 11*. 1827.

I agree with previous authors that the description and illustration is representative of a species of *Daphnopsis*. Unfortunately, both the description and the illustration are sufficiently vague so as to confound placement of the epithet on any extant specimen. It could be placed upon any of five or six species of the subgenus NEIVIRA.

2. Daphnopsis caribaea var. peruviensis Domke, in Notizbl. 12:727. 1935. [T.: *Weberbauer 1813*]

I have been unable to locate any specimens referable to this variety. The type has not been located.

Peru: tarma: Janin, La Merced im Chanchamayotal, *Weberbaur 1813*.

3. Daphnopsis dircoides Steyerm. in Fieldiana 28:420. 1952. [T.: *Steyermark 60136* (s)!]

I cannot be certain that these sterile specimens represent a species of *Daphnopsis;* they do appear to be thymelaeaceous.

Venezuela: bolívar: Sorroropán-tepui, crest of cerro between east and west end, *Steyermark 60136* [(s) F, NY].

4. Daphnopsis ekmanii Domke, in Fedde, Rep. Nov. Sp. 32:85. 1933. [T.: *Ekman H15259* (s)!]

I cannot be certain that the collection represents a species of *Daphnopsis* but the leaves are similar to those of *D. helleriana* Urb.

Dominican Republic: samana: Laguna, Loma Zaramagua, *Ekman H5259* [US (s)].

5. DAPHNOPSIS ULEI Gilg, ex Domke, in Notizbl. 12:725. 1935. [T.: *Ule 3754*]

I have been unable to obtain specimens referable to this epithet; the type has not been located.

BRASIL: RIO DE JANEIRO: Serra do Itatiaia, *Ule 3754*.

6. DAPHNOPSIS UMBELLULIGERA Domke, in Notizbl. 12:730. 1935. [T.: *Ule 4765*]

On the basis of Domke's description I am inclined to believe that this species is similar to *D. racemosa*; whether it is synonymous with it is impossible to determine. The Ule specimen was probably destroyed at Berlin in 1942.

7. DAPHNOPSIS ZAMORENSIS Domke, in Notizbl. 12:729. 1935. [T.: *Lehmann 4823*]

I have been unable to locate specimens of this species but from Domke's description I am inclined to believe that it is a good species of subgenus NEIVIRA.

ECUADOR: East Andes from Loxa to Zamora, 1000–1500 m., F. C. *Lehmann 4823*.

EXCLUDED SPECIES

1. *Daphnopsis ericiflora* Gilg & Markgraf, in Fedde, Rep. Nov. Sp. 19:113. 1925. = *Funifera* sp. acc. to Domke, in Bibliotheca Bot. 27^{111}:127. 1934.

Examination of the type material leads me to agree with Domke regarding this species. The type is a staminate specimen of *Funifera*.

2. *Daphnopsis longipedunculata* Gilg, ex Domke, in Notizbl. 12:723. 1935. = *Funifera* sp.

Examination of the type specimen of this species indicates that it properly belongs to the genus *Funifera*. The eccentric style is particularly diagnostic.

3. *Daphnopsis weberbaueri* Domke, in Notizbl. 12:722. 1935. = *Ovidia* sp.

Examination of the type material of this species indicates that it properly belongs to the genus *Ovidia*. The collector, Von Weberbauer, was of the opinion that his specimens were representative of *Ovidia* but Domke disagreed and placed them in *Daphnopsis*. Domke's decision was based on characters of the disc, the amount of phloem fibers in the leaf, the distribution of the respective genera and possibly the sessile anthers. The genus *Daphnopsis* is variable in these characters and there is no reason to believe that *Ovidia* is not also variable. The style is clearly eccentric and this is sufficient to place the specimens in *Ovidia*. It is true that this species lies outside the present range of *Ovidia* but the disjunction may be due to lack of collection.

Enumeration of the Species

Subgenus I. daphnopsis

1. *hispaniolica* Nevl.
2. *purdiei* Meissn.
3. *caracasana* Meissn.
4. *macrophylla* (HBK.) Gilg
5. *purpusii* Brandg.
6. *mollis* (Cham. & Schlechtd.) Standl.
7. *perplexa* Nevl.
8. *monocephala* Donn. Sm.
9. *helleriana* Urb.
10. *equatorialis* Nevl.
11. *oblongifolia* Britt. & Wils.
12. *calcicola* Ekm. ex Urb.
13. *occidentalis* (Sw.) Krug & Urb.
14. *liebmannii* Nevl.
15. *mexiae* Nevl.
16. *guacacoa* Wr. ex Griseb.
17. *crassifolia* (Poir.) Meissn.
18. *philippiana* Krug & Urb.
19. *brasiliensis* Mart. & Zucc.
20. *angustifolia* Wr. ex Griseb.
21. *cuneata* (Griseb.) Radlk.
    - 21a. ssp. *cuneata*
    - 21b. ssp. *uniflora* (Urb. & Ekm.) Nevl.
22. *americana* (Mill.) J. R. Johnston
    - 22a. ssp. *americana*
    - 22b. ssp. *salicifolia* (HBK.) Nevl.
    - 22c. ssp. *cestrifolia* (HBK.) Nevl.
    - 22d. ssp. *guatemalensis* Nevl.
    - 22e. ssp. *tinifolia* (Sw.) Nevl.
    - 22f. ssp. *ecuadorensis* (Domke) Nevl.
    - 22g. ssp. *caribaea* (Griseb.) Nevl.
23. *flavida* Lundell
24. *macrocarpa* Nevl.
25. *alainii* Nevl.
26. *pavonii* Meissn.
27. *pseudosalix* Domke
28. *anomala* (HBK.) Nevl.
29. *radiata* Donn. Sm.
30. *tuerckheimiana* Donn. Sm.
31. *selerorum* Gilg
32. *brevifolia* Nevl.
33. *punctulata* Urb.
34. *ficina* Standl. & Steyerm.

Subgenus II. neivira

35. *utilis* Warm.
36. *espinosae* Monachino
37. *alpestris* (Gardn.) Benth. & Hook. f.
38. *schwackeana* Taub.
39. *racemosa* Griseb.
40. *coriacea* Taub.
41. *sellowiana* Taub.
42. *beta* Taub.
43. *sanctae-teresae* Nevl.
44. *martii* Meissn.
45. *gemmiflora* (Meirs) Domke
46. *boliviana* Nevl.

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